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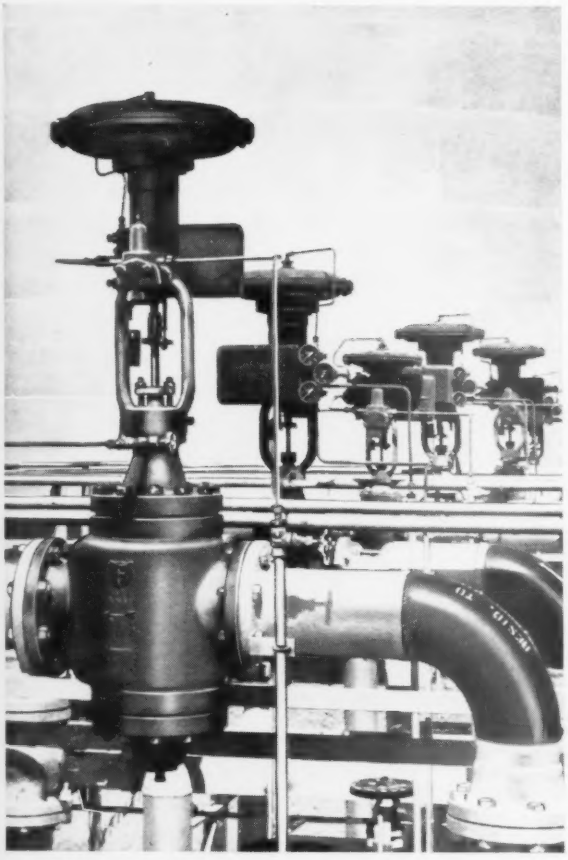

Fisher Control Valves at No. 3 Pump House (Oil Blending) at Aden. 330 of these valves are installed throughout the new 5,000,000 tons a year refinery. Photograph by courtesy of The British Petroleum Co. Ltd.

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Vol. 9, No. 100 **April 1955**

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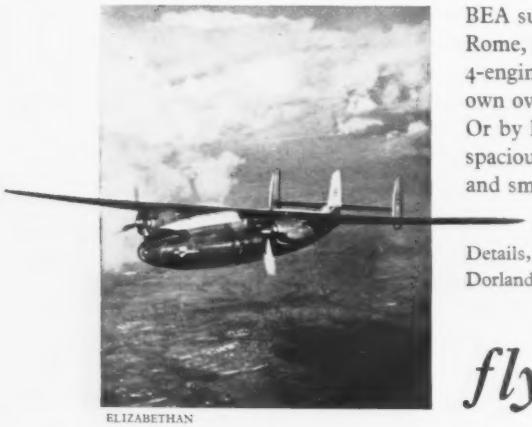
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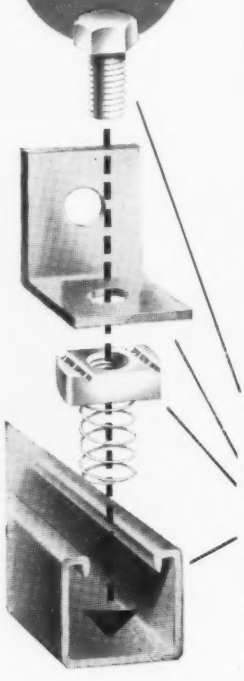

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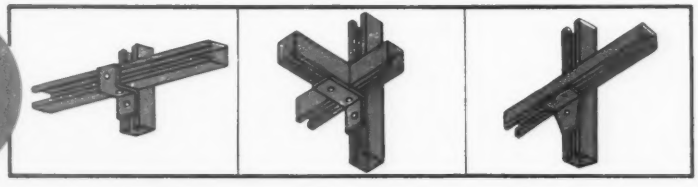
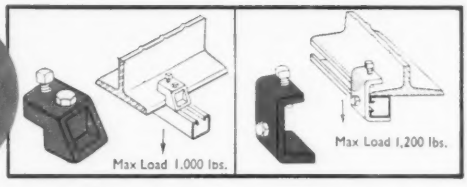
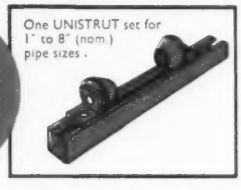


BEAM CLAMPS



ROLLER PIPE SUPPORTS



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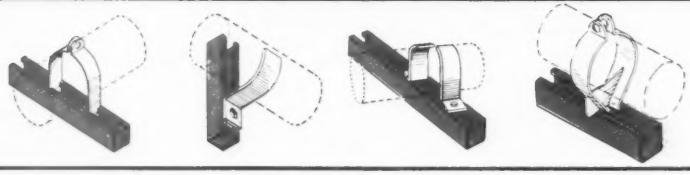

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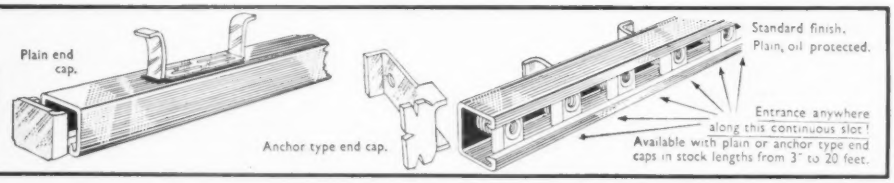
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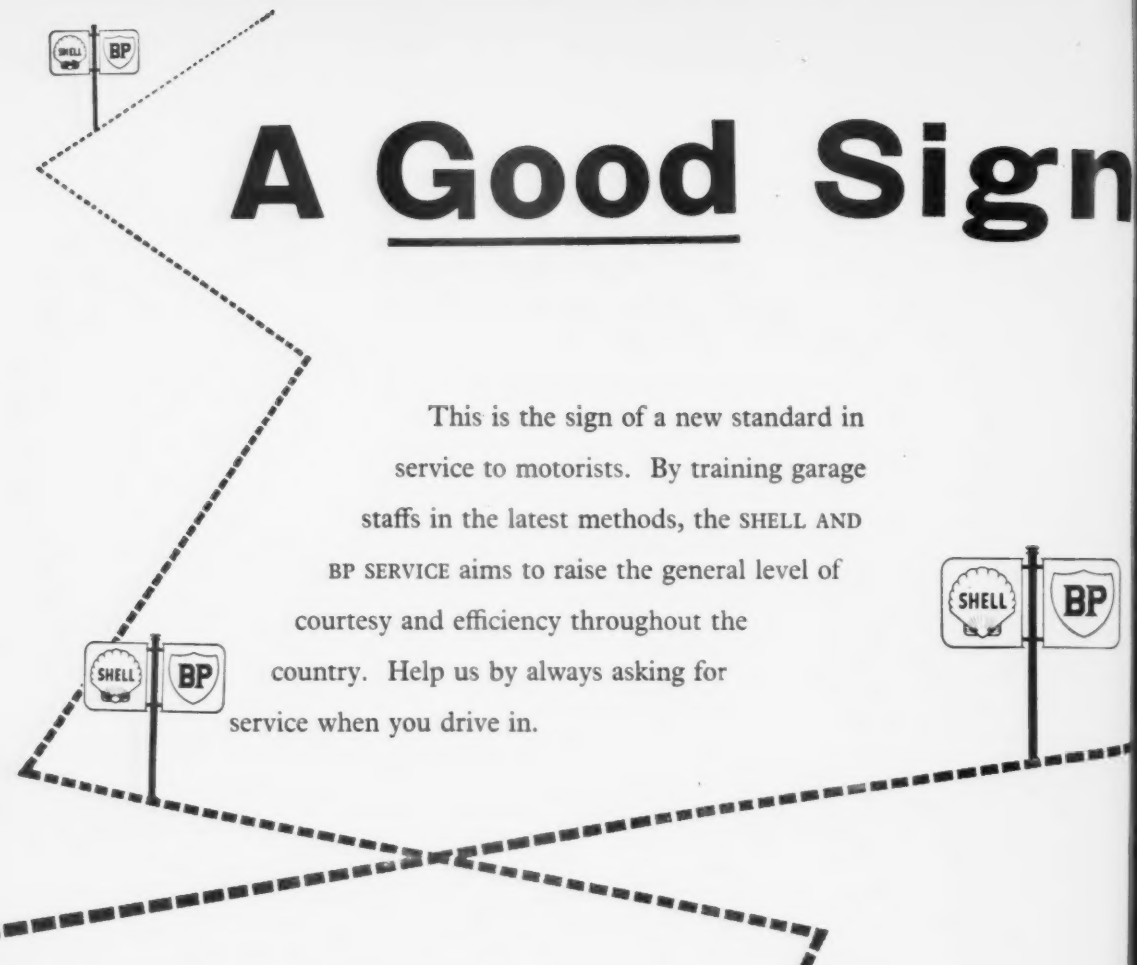

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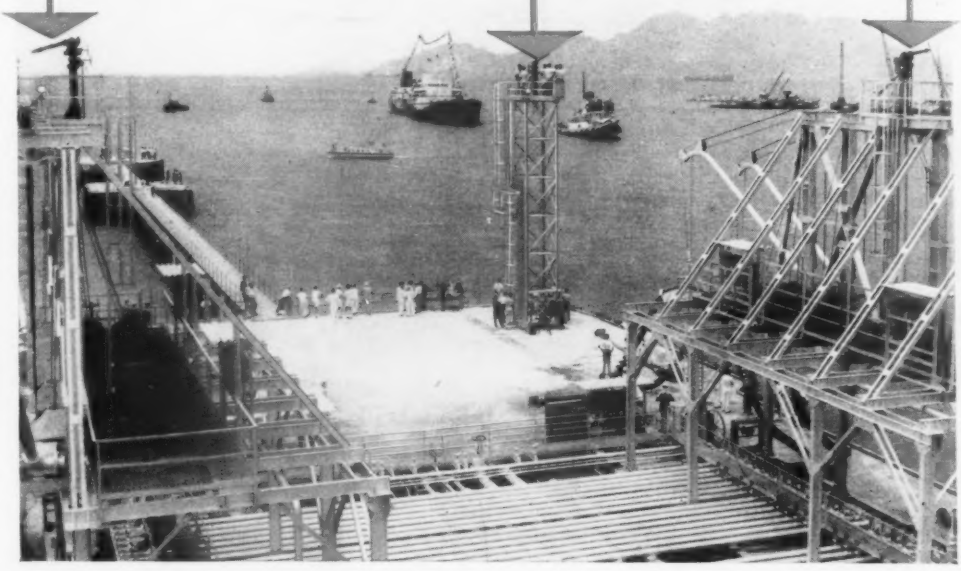
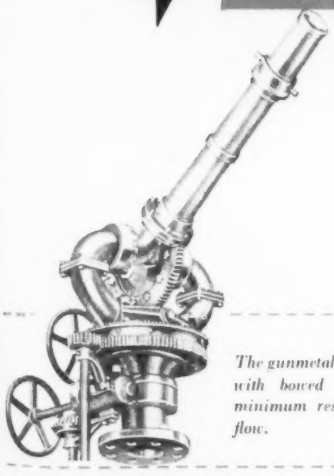


Foamite JETTY MONITORS



Standing fire guard along the jetty at Aden are the familiar Foamite Foam Monitors mounted on steel towers. Altogether there are 12 of these monitors in this installation spaced at strategic intervals. Three can be seen in the photograph taken on the occasion of the arrival of the first tanker in the harbour.

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Photograph by courtesy of The British Petroleum Co. Ltd.

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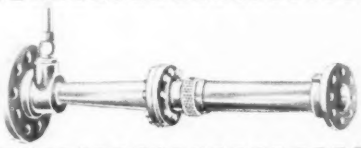

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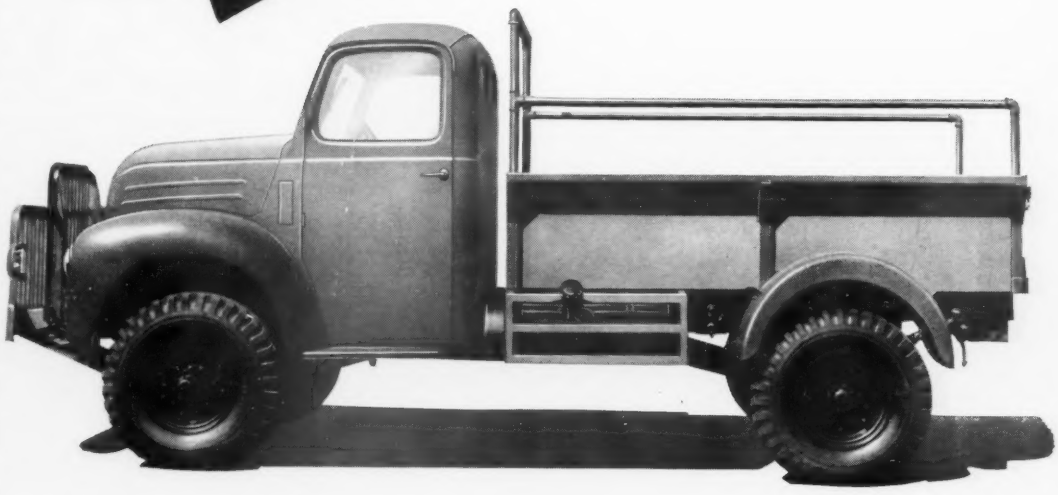

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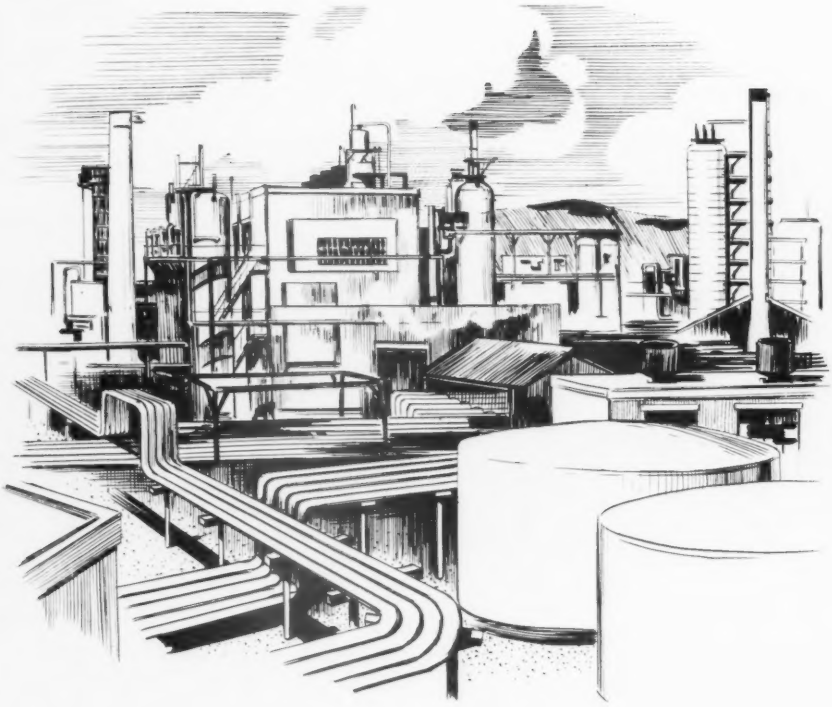

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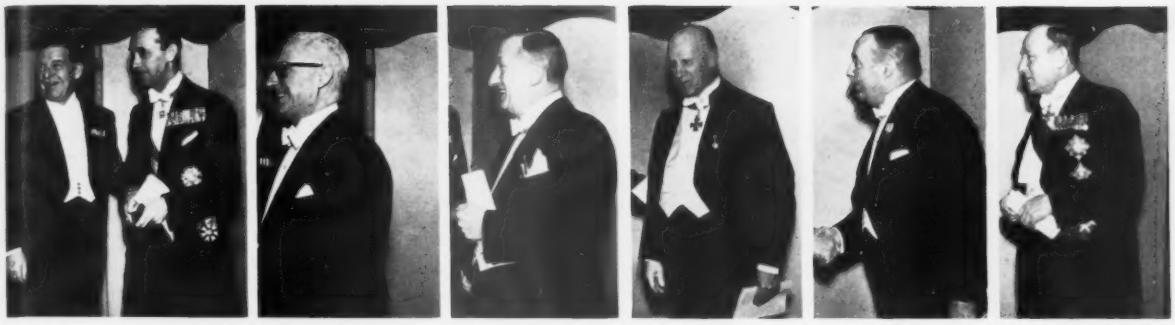

The President greets some of his guests at the 1955 *Annual Dinner,* (left to right) *General Sir Gerald Templer, Sir Leonard Sinclair, W. E. Jenkins, Sir Robert Robinson, B. R. Jackson and General Sir Ouvry Roberts.*

The 1955 Annual Dinner

Twelve hundred members of the Institute and their guests, assembled at Grosvenor House on 23 February for the 1955 Annual Dinner of the Institute, heard the Minister of Fuel and Power, The Right Honourable Geoffrey Lloyd, M.P., speak of the achievements of the oil industry during the second world war and of its contribution to the supply of world energy in the future.

The Minister was guest of honour at the dinner and the chair was taken by the President of the Institute, Colonel S. J. M. Auld, O.B.E., M.C. Also present was The Honourable Lincoln Gordon, Minister of Economic Affairs at The United States Embassy, London.

The official guests included: Major-General W. E. V. Abraham, C.B.E., managing director, The Burmah Oil Co. Ltd.; R. J. Ayres, C.B.E., accountant-general, Ministry of Fuel and Power; L. W. Berry, O.B.E., President, The Oil Industries Club; F. Bowring, chairman, Lobitos Oilfields Ltd.; L. M. Broadway, managing director, C. C. Wakefield and Co. Ltd.; J. C. Colquhoun, M.B.E.; H. W. Fisher, Standard Oil Co. of New Jersey; J. C. Gridley, chairman, Vacuum Oil Co. Ltd.; F. E. Harmer, C.M.G., director, The British Petroleum Co. Ltd.; G. H. Herridge, director, Iraq Petroleum Co. Ltd.; Dr. W. Idris Jones, President, The Institute of Fuel; B. R. Jackson, deputy chairman, The British Petroleum Co. Ltd.; W. E. Jenkins, C.B.E., managing director, Esso Petroleum Co. Ltd.; J. B. Kay, oil geologist, The Ministry of Fuel and Power; R. Kelf-Cohen, C.B., Under-Secretary, The Ministry of Fuel and Power; Prof W. B. R. King, O.B.E., M.C., President, The Geological Society; W. F. List, assistant managing director, C. C. Wakefield and Co. Ltd.; Sir Alexander McColl, Kt.; E. H. Moline, Petroleum Attache, The United States Embassy, London; G. F. R. Marsh, C.B., Director of Stores, The Admiralty; N. E. Martin, private secretary to the Minister of Fuel and Power; Vice-Admiral (E) Sir F. T. Mason, K.C.B., C.B.E., Engineer-in-Chief to the Fleet; Sir John Maude, G.C.B., C.B.E., Secretary, The Ministry of Fuel and Power; Sir William Ogg, President, The Society of Chemical Industry; J. J. Parkes, President, Society of British Aircraft Construction; General Sir Ouvry Roberts, G.C.B., K.B.E., D.S.O., Quartermaster General to the Forces; Sir Robert Robinson, O.M.; H. A. Sargeaunt, O.B.E., scientific adviser to the War Office; C. A. E. Shuckburgh, C.B., C.M.G., Assistant Under-Secretary of State, The Foreign Office; Sir Leonard Sinclair, Kt., chairman, Esso Petroleum Co. Ltd.; Brigadier R. S. G. Stokes, C.B.E., D.S.O., M.C., President, Institution of Mining and Metallurgy; General Sir Gerald Templer, G.C.M.G., K.C.B., K.B.E., D.S.O.; C. M. Vignoles, O.B.E., managing director, Shell-Mex and B.P. Ltd.; Sir Owen Wansbrough-Jones, K.B.E., C.B., chief scientist, The Ministry of Supply; Sir Lawrence Watkinson, K.B.E., C.B., M.C., Deputy Secretary, The Ministry of Fuel and Power; Dr H. F. Willis, Royal Naval Scientific Service; D. Wilson, President, The Council of British Manufacturers of Petroleum Equipment.

Among the Members of Council present were: (*Past-Presidents*) E. A. Evans; Prof F. H. Garner, O.B.E.; H. S. Gibson, C.B.E.; and C. A. P. Southwell, C.B.E., M.C. (*Vice-Presidents*) H. Hyams; J. A. Oriel, C.B.E., M.C.; H. E. F. Pracy; R. B. Southall, C.B.E.; and G. H. Thornley. (*Members*) W. S. Ault; S. A. Berridge; V. Biske; W. H. Davies; E. J. Dunstan; Dr E. B. Evans; F. L. Garton; A. J. Goodfellow; N. W. Grey; E. LeQ. Herbert; J. S. Parker; D. L. Samuel; E. J. Sturgess; O. F. Thompson, O.B.E.; A. T. Wilford; Dr C. G. Williams; and C. S. Windebank. The Honorary Secretary of the Institute, C. Chilvers, was also present.

The Industry and the Institute

The Right Honourable Geoffrey Lloyd, M.P., in proposing the toast of "The Petroleum Industry and the Institute of Petroleum", said:

The President with The Honourable Lincoln Gordon.

81

79
67
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69

it is a particular pleasure for me to have this opportunity of speaking to you tonight, for I am in the unique position of having both a great admiration and a sincere affection for the oil industry.

Some of you perhaps when you hear me say this may be wondering why I talk about affection as well as admiration. Yes, you may say, we can understand the admiration. For we are a most terrific industry. We are one of the most dynamic industries in the world. We are, at the present time, the most dynamic fuel industry in the world. But why does the sentimental Minister talk about affection for a thing like the oil industry?

I should like to explain. My connexion with the oil industry was to be the Minister responsible in this country with the oil industry for oil supplies from the beginning to the end of the German war. We, so to speak, came together in such dramatic circumstances in 1940 that I can never think of the work that was done by this industry without a degree of emotion. As you know I went through, with the leaders of the industry, those terrible anxieties that we had on the oil supplies for this country and for the whole military effort of the British Empire in the terrible days of the latter end of 1940 and, even worse, in the acute phase of the Battle of the Atlantic in 1941. Those of us in the Oil Control Board in those days, and in the Department, had that terrible experience, which had to be shared by us in secret because the public knew nothing about it, of the remorseless fall, week by week, and day by day, in the oil stocks which we knew to be the lifeblood of the military effort of our country in the war. It was very dramatic, and I cannot remember those days without thinking of the tremendous comradeship in vital work that we had at that time. I should also like to recall, particularly with Mr Lincoln Gordon and Sir Leonard Sinclair, the wonderful assistance and help and comradeship in that job that we had, not only from our own great oil companies, with which we know we are so closely associated, but from Jersey, in those days Anglo-American and now Esso. I can remember the work that was done by Emile Soubry when he went over to the United States, and when Jersey re-arranged their transportation of oil from the Carribbean to the Eastern sea-board, so as to supply this country with a great many more tankers that we so badly needed at that time, before the United States ever came into the war at all.

Now, we do not forget those things. But, Mr President, there were other things as well, because the first time you and I met, was on the complicated question whether the new flame throwers which had then come into my life were to be powered by compressed gases, or by a special type of centrifugal pump. There was the sudden development, as the result of a suggestion by the Fourth Sea Lord at that time and the Admiral commanding the Nore, that instead of destroying our petroleum stocks if there were a German invasion we might at least use them to try to burn up as many Germans as we possibly could before we went down. That was the beginning of petroleum warfare, and almost in a twinkling we had engineers from all the great companies setting up those Fougasses in the gaps in the Channel coast, and all the other devices. I must admit the War Office looked a little bit askance at them occasionally, although they did adopt them officially and many soldiers were very enthusiastic about them. Nevertheless, a little later on they looked very extraordinary to us when we turned over from this purely stop-gap defensive type of weapon to the design which eventually made this country the leading exponent of the flame-thrower (originally the German weapon). We turned the tables on them, and produced here, in this country, the most powerful flame-throwers in the world by the end of the war. That, and also the Pluto pipeline, and the Fido fog-disperser, were achieved only by virtue of the astonishing technical vitality and co-operation of the oil industry. So, you will see, gentlemen, why it is that although I have only touched on a few points out of many years of tremendous co-operation and work I have not only admiration, but also a real affection for this great industry.

There are two important points from the point of view of the Government with regard to the oil industry at the present time.

One is the tremendous contribution that oil is making now and will increasingly make to the fuel needs of the United Kingdom. As you know, the country is so active, our industry

Major-General W. E. V. Abraham (left) *and J. C. Gridley* (centre) *chat with the President.*

is so expanding, our fuel needs are rising therefore so very much that our coal output cannot possibly expand in tune with the needs of the industry. Therefore we need more and more oil to make up the difference. It is a very great service that the industry is rendering by coming in to provide much increased supplies of fuel oil—for central heating, for other needs, the expanding needs of fuel oil in general, and also particularly, to take part instead of coal in the fuelling of our expanding electrical supply system. That is very important, the Government wish it to continue and to expand, and we are very grateful to those who have helped this movement to get going.

The other point is the question of nuclear power. Undoubtedly, atomic energy is going to be one of the great factors in the energy pattern of supply in future years. It is true that it is quite a considerable way off in terms of really big supply, but the point that I want to make tonight is this: that however fast we can foresee nuclear energy expanding in practical terms, as far as the Government is concerned, we cannot see any fundamental damage to the oil industry. Just as I said in the House of Commons, when I announced this programme only last week, that we shall, in this country, fundamentally depend upon the coal industry in the lives of our children, and our children's children, so I would say that even more is it the case in regard to the oil industry, that not only this country, but the world, will have a fundamental need for the extraordinarily diversified forms of energy supplied by this great industry.

Let me give you just one example. You know that, in the first instance, nuclear energy will give its help to civilization through the electricity supply system, and it is true that by the enterprise of that great country across the sea, there has been the development of atomic power, for example in a submarine. But I am sure that Mr Lincoln Gordon, however much he may be proud of the great technical accomplishment which that shows—and which we greatly admire—would never, for a moment, claim that in the future that we can see

immediately ahead, a development of that kind can be commercial or economic. That is an entirely different problem, and everything that we can see at the moment shows us that the small-scale type of atomic energy, while it may be technically feasible, is not going to be economic. Therefore, in all that tremendous field, where the oil industry is particularly capable of providing energy in an extremely convenient form, it does not look as if there can be any competition at all, of any serious kind.

I want therefore, gentlemen, to conclude my observations by saying that I hope you will excuse my slightly sentimental approach to the oil industry, which I am sure must be rather a new one for you, and to say that it does give me the very greatest pleasure this evening to propose the toast of the petroleum industry and the Institute of Petroleum, coupled with the name of my old friend, your President, Colonel Auld.

The President's Reply

Replying to the toast of "The Petroleum Industry and the Institute of Petroleum", Colonel S. J. M. Auld said:

To thank Mr Geoffrey Lloyd and then to come after his invigorating speech has not only its responsibilities but also obvious difficulties.

If he will forgive me for putting it like this I would say he is a difficult bird to flush; indeed this is the first time he has appeared at an Institute of Petroleum major function. But when one does get him into the open and on the wing his enthusiasm and his wisdom are, as we know, certainly strong enough to put life even into a dry-as-dust President's address.

I should, I believe, start off by giving an account of my year's stewardship. But I have gone on record so frequently as decrying statistics that I feel you will let me off by accepting and underlining all the Minister has said and adding to it that the Institute of Petroleum, with the help of its fine permanent staff, its ever-expanding membership, and last but not least the support of its member companies, is doing very well, thank you.

It would become me, however, to point out that we now have twelve fully active Branches, ranging in location from the torridity of the Persian Gulf to the salubrity of the Scottish Lothians, and as far distant as the now "ashless" zone of Australia.

It might also be reasonable to refer to the broadening of the Institute's basis by Group formation. The first group "The Economics and Operations Group" has proved highly successful, and that is significant as an indication of the new and important less-technical interests which the Institute is in process of embracing.

But my real theme is to re-emphasize the international character of oil and the extent to which the Institute of Petroleum is serving that great characteristic.

Oil is a main factor in raising the world's standards of living and keeping nations friendly. Wherever it arises, wheresoever it is introduced, petroleum means comfort and warmth and light, transportation, soil fertility, and nylons. Up goes the standard of living!

Oil is the common denominator—almost a currency. If there is such a key-commodity-commonwealth in oil then its leader is the U.S.A.; but we are treading closely on their heels! It is with them we collaborate, from them we continue to learn, and with them we are proud to compete. I mention competition because it is one of the great arts of friendship. Real competition can only be between men of equal stature. It must be sought for and satisfied.

The other day I was reading the "Times" for 18 April 1860. The centre page had nearly three columns devoted to the championship fight on the border of Hampshire and Surrey between Sayers, the British champion, and his American opponent, Heenan. It was the last of the bare-fist

fights and prior to the encounter the "Times" sententiously writes:

". . . all decent people disliked the idea of two fine men beating each other half to death... It was nevertheless devoutly to be wished that as somebody be beaten, it might be the American."

This may not be entirely appropriate to my point, but it will serve since it was generally agreed that the fight, which lasted nearly three hours, was a draw. Also, for many years afterwards no other country but Britain or America provided the world champion.

At the pace things go nowadays Time seems to have ceased using his hands gently. Down the Ages things progressed in somewhat stately fashion. But nowadays even the word "Age" is less discriminating. We even have the Detergent Age—when it is almost certain that we wash far too much already. But before the Atom Age creeps on us let us realize that this truly is the Era of Liquid Hydrocarbons. The Oil Age. But still a very short one.

It is still less than 100 years since Colonel Drake, whilst drilling for brine in Pennsylvania, brought in the first oil well and thereby unloosed the flood of petroleum on which our modern transport seems to be capering to some impressive but unspecified climax. Supposing Drake and all subsequent drillers had found only salt water, where would we be for our party tonight? There would have been no parking problems to solve, anyhow. So much of our so-called civilization has been based on the piston-type internal combustion engine and so little of that would be possible without petroleum. The world would be very different.

What are we doing with it? There are still great things to do. Our forefathers thought hardly of our impiety in taking this oil out of the ground where it was in obvious storage to provide the fiery pits for the Day of Judgment. Well, they may have had something. But it is more likely that Noah missed the opportunity of pouring oil on his troubled waters. It is up to us to do so now and use this great gift to humanity to calm a troubled world by its beneficent application.

There has been little turning back in the short history of petroleum. It is a constant move forward to greater and newer things. The Institute of Petroleum has a great responsibility in representing this giant, this new industry, and helping to guide its promise for the benefit of us all. This can only be done by the acquisition and spread of knowledge.

The broader the basis, the higher the structure which we can build. It is for that reason that the Institute is pledged to the international exchange of knowledge, and of standardization; first and foremost with America.

"The Guests"

Colonel Auld went on to say: I now turn to my final and very pleasant task of proposing the toast of our guests. It is quite obvious that I cannot refer to each by name or association, but I will exercise my prerogative in respect of a soldier and of a scientist.

The man of science is Sir Robert Robinson, who undoubtedly is the greatest organic chemist that we have had in the last generation or more. He has also this association with ourselves, that he is particularly interested in the chemistry of petroleum.

The soldier is that gallant gentleman, Sir Gerald Templer. And if Sir Gerald is duly impressed by the size of this gathering, and goes away with the feeling that if, in his future career, he should need it, he has the support of an alive and willing oil industry, then we are contented.

I am sure also, that you will agree with me that it is most appropriate that I should couple this toast with the name of a brilliant young American, that is Mr Lincoln Gordon, the Minister of Economic Affairs in the Embassy of the United

The Honorary Secretary (right) *photographed with the General Secretary.*

States of America to the Court of St. James'. His presence here tonight is highly to the point in more ways than one because, apart from his special knowledge and special interests, Mr Gordon has a particular claim to internationalism in that he is a graduate of Harvard and also a graduate of Oxford. And that, as I think you will agree, and as Mr Damon Runyon would have said, is more than something. I now drink to our guests, coupled with the name of Mr Lincoln Gordon.

The Honourable Lincoln Gordon, in responding on behalf of the guests, referred to the enormous importance and tremendously dynamic character of the oil industry.

It was, Mr Lincoln Gordon said, a fantastically successful industry in all sorts of ways. Sometimes, however, one had a feeling that the industry took its success and its growth, its expansive attitude and dynamism for granted. One never blamed the successful for taking success a little for granted but, speaking as a very interested layman, Mr Lincoln Gordon wondered whether the industry did not do itself a slight disservice by taking things too much for granted.

He continued: "Certainly there are obstacles of one kind or another. You are familiar with the physical ones, and you are used to overcoming those easily; you are certainly familiar with the financial ones and are thus far, at least, overcoming those pretty well. From time to time, however, you have probably noticed that there are also political difficulties in one or another form in different parts of the world—difficulties which arise partly from misunderstandings on the part of public opinion, and I would like to raise a question as to whether the industry always puts its best foot forward in that particular connexion. I am not sure that it does. I know that it tries. I know that it has a very good story to tell, but I sometimes wonder whether it does tell the story quite as fully and quite as effectively as it might. Certainly, one can understand why it is a hard story to tell. It is such a complex industry; it is growing; it is changing under our eyes; sometimes, perhaps, it is felt (I think on the whole wrongly) that there are some things it would be better not to disclose. Obviously, in connexion with strategic considerations there are some matters which, in the broad public interest, must not be disclosed. A lot more of the story, however, could be told. It would seem to me, on the whole, a wise attitude on the part of the industry if it were prepared to make more of a point of trying to say more, and say it in a way which would be both comprehensive and comprehensible—in other words, an easy task to accomplish."

"There is a great public interest in the industry. In fact, I have noticed that a little thing like a halfpenny change in the price of gasoline is capable of causing remarkable public interest. In this connexion, while I am not really a technician, I once thought that I might become a chemist and so I understand a little bit about high and low fractions, I have been surprised to notice lately, Mr Minister, that tea is apparently more volatile, even, than the highest petroleum distillates. I am sure that public understanding, a better handling of public relations, is something that will come, along with all the other successful dynamics of this industry."

Speaking of the guests for whom he was acting as spokesman, Mr Lincoln Gordon said that their diversity reminded him a little of an American family which, when the census report was taken, was found to consist of a man, a woman, a child, a cow, and a cat. The census report listed their political sympathies and they were put down respectively as Democrat, Republican, wet, dry, and Free Trader.

Although the guests assembled were so diverse, however, they did share some things in common with each other and with their hosts. This was particularly true of those from the United States and the United Kingdom. An extraordinary international collaboration existed between the two great petroleum industries of Britain and the United States and between the two governments in connexion with petroleum. If one turned to the more general aspects of the Cold War, one could not look back upon last year's experience of the successful joint effort by the British and the American oil industries, and the two governments, in successfully resolving the really perilous problem of Persian oil, without recognizing that it was one of the truly historic episodes in successful Anglo-American collaboration in the interests of the whole free world.

In addition, there was general recognition of the remarkable degree of interdependence of various interests concerned, among producing countries, consuming countries, companies, governments, suppliers of equipment, and consumers generally. This community of interest could well stand more effective stressing in seeking public understanding of what happened in this extraordinary industry.

Mr Lincoln Gordon then went on to speak of the far-reaching ramifications of this interdependence and of the possibility that the petroleum industry would play a major role in helping the advancement of under-developed peoples.

On the question of atomic energy, Mr Lincoln Gordon concurred with the Minister of Fuel and Power in the view that there would be ample room for all sources of energy in the future—both conventional and nuclear—and expressed the opinion that there would certainly be room for all the petroleum industry could do to meet energy demands. He was of the opinion, however, that the use of atomic energy would come faster than was now foreseen and also more economically.

Finally, Mr Lincoln Gordon referred to the President of the Institute and said that he himself was a living symbol of Anglo-American collaboration. As a soldier he had been attached to both British and American army units, and in his petroleum career he had worked first with a British company and later with the British subsidiary of an American oil company. His position as President of the Institute of Petroleum indicated the benefit to be gained from combined Anglo-American experience.

All photographs by the Grosvenor House Photographic Service.

Guests at the third annual dinner of the Kuwait Branch. (Left to right) *V. J. Chir; Sir Herbert Todd* (speaking); *R. M. S. Owen; W. Ensor; H. M. Symmes* (speaking); *E. Boaden; J. J. Page* (speaking); *C. J. Pelly* (speaking); *V. J. Chir.*

Around the Branches

FAWLEY, LONDON, NORTHERN, PERSIAN GULF, SCOTTISH, SOUTH EASTERN, SOUTH WALES, STANLOW, TRINIDAD

Fawley Branch

At a meeting of the Branch held in the Esso Recreation Club on 14 January the speaker was C. A. Beard, A.M.I.Mech.E., A.F.R.Ae.S., of Ricardo and Co. Ltd.

The paper read by Mr Beard was "Engine Design as Influenced by Fuels and Lubricants"—the first part of which was published in the March issue of the *Review* and which is concluded on page 87 of this issue.

Following the lecture, many questions were asked by the audience and the meeting closed with a vote of thanks proposed by R. Wilkinson.

Kuwait Branch

One of the last important events of the Kuwait sub-branch before it attained full Branch status was the holding of its third annual dinner at the Guest House, Ahmadi, during January.

Guest of honour at the dinner was Sir Herbert Todd, C.I.E., chief representative in Iraq of the Iraq Petroleum Company, and over a hundred members and guests were present at the dinner—including the Branch chairman, V. J. Chir.

The first speech of the evening was made by H. M. Symmes, American Consul in Kuwait, who proposed the toast to the oil industry. He paid tribute to all oil people and spoke briefly of the past, present, and the "fantastic future" of the oil industry.

Sir Herbert Todd, in reply, spoke at some length of the strategic importance of oil in the Middle East and of the part that oilmen could play in bringing stability to that part of the world. Our responsibilities in the Middle East, Sir Herbert said, were not apparent to everyone. Many of the old faiths, customs, and beliefs had been disrupted by the wealth that oil had brought and something had to be put in their place other than just riches and the things that go with wealth. There was a moral responsibility to bring stability through integration. The people of the Middle East needed help and we must "persuade them to come to the conference table with us knowing that their interests are also ours".

"The Institute"

The toast of the Institute was proposed by C. J. Pelly, C.M.G., O.B.E., Her Britannic Majesty's Political Agent in Kuwait, who referred to the Institute as a forum for the exchange of ideas which would play a useful part in maintaining and improving the partnership of oilmen with the people of the Middle East.

Replying to this toast, J. M. Dougary, vice-chairman of the Branch, referred to another aspect of the Institute's work. The oil industry, he said, was not without its rivalries but in the Institute these inter-company and inter-professional rivalries were largely forgotten. As far as the Institute was concerned in Kuwait members were drawn from a very wide cross-section of the community and the meetings provided a most useful means of allowing members to see how the rest of their colleagues functioned in the company organization, and so see and appreciate their difficulties.

The toast to the guests was made by the chairman, V. J. Chir, and this was replied to by J. J. Page, assistant general manager of the Qatar Petroleum Company. The speeches closed with a vote of thanks to the chairman and secretary, E. J. Sole, and to all who had worked to make the dinner a success.

Scottish Branch

A joint meeting of the Scottish Branch of the Institute and the Stirlingshire and District Sections of the Royal Institute

(Left to right) *J. M. Dougary* (speaking); *W. Ensor; H. M. Symmes.*

Guests at the annual dinner of the Kuwait Branch.
(Left to right) *E. Boaden; C. J. Pelly; V. J. Chir* (speaking); *Sir Herbert Todd; R. M. S. Owen.*

of Chemistry and the Society of Chemical Industry was held in the Recreation Hall at Grangemouth refinery on 17 February.

Mr Caldwell, chairman, welcomed the members of the Stirlingshire and District Sections of the R.I.C. and S.C.I., and said that this was the first joint meeting and he hoped there would be many more. Introducing the speaker, W. Jamieson, M.A., B.Com., Mr Caldwell said that Mr Jamieson joined The British Petroleum Co. Ltd. in 1936, and after service in Persia was transferred to the Central Planning Department, London. In 1954 he was appointed manager of the Economics and Statistics Branch of the Supply and Development Division.

Mr Jamieson's talk, which was illustrated by a large number of diagrams, covered the economic aspects of the world oil industry, beginning with a survey of world energy and the growing part played by oil. The world pattern of supply and demand for oil was described, and the enormous transport problem was considered. Some of the future problems of the industry were mentioned, especially the availability of supply and the location of proved reserves.

After answering many questions, Mr Jamieson was accorded a hearty vote of thanks proposed by Dr W. L. Wood, chairman of the Stirlingshire and District Section of the Society of Chemical Industry.

An anxious moment at the South-Eastern Branch Annual General Meeting. "Is that right Mr Secretary?" asks chairman Noel Grey while Mr Challis, treasurer, looks hopefully on. The pandemonium falls into silence as Mr Moore answers "Yes sir, subscriptions for 1955 are due on January 1st."

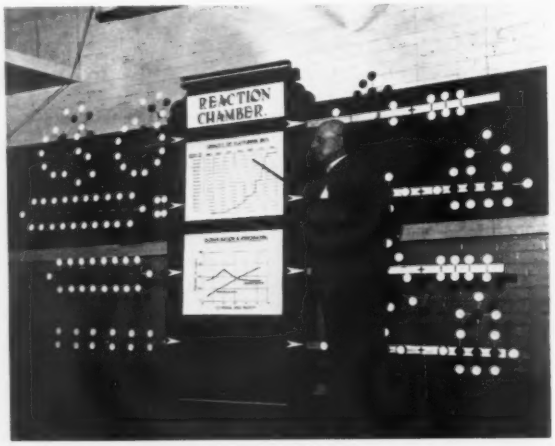
South Wales Branch

On 6 January at the Training Centre, National Oil Refineries Ltd., A. W. Jeffery gave a talk on "Petroleum and Platforming". The chair was taken by J. A. Green and a large audience attended.

Mr Jeffery briefly sketched the history of petroleum from the very early use of bitumen to the modern uses of petroleum products. He then proceeded to discuss in some detail the principles and technique of platforming, with the help of informative slides and models illustrating the molecular configuration of the chemical compounds involved. Mr Jeffery spoke of the seven main reactions which make up the process: dehydrogenation of naphthenes, isomerization of naphthenes, hydrocracking, isomerization of paraffins, dehydrocyclization, desulphurization, and hydrogenation.

An interesting discussion followed which was highlighted by Mr Jeffrey's amusing analogies, especially one in which the life of a catalyst was compared with that of an egg.

Dr Howes, in proposing the vote of thanks, paid tribute to the lecturer for his obviously very thorough preparation of his paper and the characteristic and forceful manner in which it was given.



The lecturer, A. W. Jeffery, explains a schematic diagram at a meeting of the South Wales Branch.

Stanlow Branch

The sixteenth annual general meeting of the Branch was held at The Grosvenor Hotel, Chester, on 19 January.

Following this a lecture entitled "The Outlook for the Oil Industry" was given by G. P. Glass of the Shell Petroleum Co. Ltd.

The main theme of the lecture was the world energy supply position, at present maintained by coal, oil, and hydro-electricity. The lecturer expressed the opinion that the future would bring an increasing demand for oil, as coal production appeared to be levelling out and atomic energy was not yet in a position to give appreciable help.

World oil reserves were dealt with and the forecast was made that there would be ample to see us well into the next century.

The financial position of the oil companies was also dealt with and a strong plea made for the reduction of taxation on a commodity essential to the national welfare. The discussion was opened by Mr Buckley of the U.K. Atomic Energy Authority, Capenhurst, and was actively maintained until the meeting closed.

Significant Figures in the Reporting of Bulk Oil Quantities and Choice of Alternative Tables

For some time past the Institute's Standardization Sub-Committee No. 1 which deals with Measurement and Sampling of Petroleum and Petroleum Products has given attention to the question of the number of significant figures which should be used in reporting measured quantities of petroleum products in bulk. The note below has been approved by Sub-Committee No. 1 and by IP Standardization Committee. Its recommendations are presented for comment by the oil industry and it is hoped that by this means uniform practice on this subject will eventually result.

The widespread adoption of the ASTM/IP Petroleum Measurement Tables has given rise to two matters which require amplification. The first of these is the question of the degree of arithmetical accuracy which should be sought when reporting quantities obtained by the use of these tables; and the second deals with the appropriate choice of one of two apparently equivalent weight volume tables.

Significant Figures

It should be borne in mind that the Petroleum Measurement Tables have been calculated to an accuracy of one part in 10,000 and this would indicate that five significant figures represent the limits beyond which additional figures would be spurious, that is to say, it would be greater than the inherent accuracy of the tables themselves; and it would almost certainly be greater than the accuracy of the physical measurements upon which the quantities are based.

In order to establish common procedures amongst the users of the tables it has been suggested that The Institute of Petroleum should give some guidance. In the next edition of its "Petroleum Measurement Manual" the Institute intends to incorporate some recommendations in the section dealing with "Calculation of Oil Quantities", but since it will be some time before a new edition of this work is called for, it has been felt desirable that the recommendations be presented now.

The Institute accordingly recommends that in reporting bulk oil quantities, all values, whatever the unit (tons, barrels, gallons etc.) should be rounded off according to the following rules:

(1) A quantity of less than 1000 units should be rounded off to two decimal places.
(2) A quantity of 1000 units or more but less than 10,000 units should be rounded off to one decimal place.
(3) A quantity of 10,000 units or more should be rounded off to the nearest unit.

It is fully realized that, according to these rules, it is permissible to quote a figure of, say 100·19 gallons, which may appear to claim more accuracy than is justified in a gallonage figure. The alternative would be to formulate a further rule applicable only to results quoted in gallons but it is felt that in the interests of simplicity the number of rules should be kept to a minimum. In any case, the rules apply only to bulk oil quantities and the necessity to quote a bulk gallonage figure small enough to involve two figures to the right of the decimal point will not often arise.

The foregoing remarks apply to final reported quantities only. Intermediate values in the course of calculation should retain sufficient figures to ensure the greatest possible arithmetical accuracy.

The following examples are taken from the Introductions to various tables of the ASTM/IP Petroleum Measurement Tables and have been chosen to illustrate those cases in which the figures quoted are not in accordance with the recommended rules.

Table	*Calculation*	*Quoted Result*	*Recommended Result*
25	8,000 × 0·97837	7,830 U.S. galls.	7,829·6 gallons
29	2,345·430 × 2·7259	6,393·41 long tons	6,393·4 long tons
37	962·477 × 3·2214	3,100·52 long tons	3,100·5 long tons
39	503·177 × 26·548	13,358·34 long tons	13,358 long tons
41	1,973·205 × 3·3234	6,557·75 metric tons	6,557·7 metric tons*
57	13,576·303 × 0·8299	11,266·97 long tons	11,267 long tons
58	13,793·88 × 6·682	92,170·7 barrels	92,171 barrels

*This has been rounded off from 6,557·749

Other examples, correctly quoted in the tables, are given below to illustrate aspects of the rules not covered by the figures given above.

Table	*Calculation*	*Result*
40	741 × 0·9319	690·54 long tons
38	1,216·11 × 259·81	315,958 Imperial gallons
52	11,844,902 × 0·22011	2,607,181 Imperial gallons

Choice of Alternative Tables

In the ASTM/IP Petroleum Measurement Tables there are two cases of apparent duplication viz. Tables 36 and 37 in Imperial units and Tables 26 and 27 in U.S. units. These tables cover the determination of the weight of a given gallonage of oil whose specific gravity at 60/60° F is known, one table dealing in pounds per gallon and the other in tons per 1000 gallons. In general, no difficulty should arise in deciding which of the two tables to use since the units being dealt in will immediately indicate the correct choice. For instance, dealing in Imperial units if the weight is required in pounds and ounces for setting on a filling machine used for filling tins, barrels or drums, Table 36 will be used, whereas if the weight required is that of a cargo of oil, Table 37 will be used.

A general rule to be applied in cases of doubt is to use that table which involves the least amount of subsidiary calculation in the reduction of units such as, for instance, reducing pounds to tons or vice versa.

It may be noted that the difficulty does not arise in the corresponding metric version (Table 56) since kilograms per litre is identical with metric tons per 1000 litres, and so only one table is necessary.

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CHEMICAL ENGINEERING CONVENTION

The 1955 European Convention for Chemical Engineering and Achema XI—Chemical Apparatus and Equipment Congress and Exhibition are to take place in Frankfurt-am-Main from 14 to 22 May.

Among the functions which will take place during the Convention are the 1955 Congress of the European Federation for Chemical Engineering and the 30th annual general meeting of the DECHEMA.

Details are available from the DECHEMA Deutsche Gesellschaft für chemisches Apparatewesen, Frankfurt-am-Main, W.13.

Trade Literature, etc.

OIL COMPANIES ORDERS IN THE U.K.

The Oil Companies Materials Secretariat has issued the following statement of the value of orders for materials and equipment placed in the U.K. by oil companies during the period October to December 1954.

The total value of orders placed during 1954 is given here.

	Oct. to Dec. 1954 £	*Jan. to Dec.* 1954 £
Geophysical and other exploratory equipment, etc.	1,300	16,700
Specialized equipment for oil drilling and production, including oil casing, tubing, etc.	1,422,600	5,374,300
Specialized equipment for oil refineries, etc. (not including pumps and valves).	1,342,200	3,320,200
Drum and can-making, filling and cleaning equipment, kerbside pumps, and other oil metering and dispensing equipment, etc.	207,400	1,040,100
Railcars, road tankers, aircraft refuellers, etc.	142,500	278,000
Drums, drumsheets, and tinplate	1,808,700	7,611,400
Tankage (including tank fittings)	899,500	3,137,600
Tubulars, pipe fittings and valves (ferrous and non-ferrous)	2,634,000	8,654,000
Pumps (excluding slush, oilwell, and kerbside)	364,600	1,477,500
Boilers, boiler house plant and accessories, etc.	138,200	504,100
Electrical equipment—motors, generators, transformers, etc.	1,152,000	4,030,800
Instruments, meters, and gauges, etc.	341,900	1,193,800
Prime movers and compressors	490,200	1,962,100
Machine and hand tools, welding and miscellaneous machinery and stores	1,571,900	5,444,700
Ferrous and non-ferrous plates, sections, sheets, and bars	683,800	2,204,900
Automotive equipment, all types	1,395,100	4,384,600
Laboratory equipment and chemicals (including hospital and medical supplies)	194,800	770,800
Bulk chemicals, catalysts, barytes, etc.	6,119,600	20,771,000
Cement and other building materials and hardware (including timber)	882,700	3,066,500
Commissary, general requisites for office, warehouse, household, club, and sports, etc.	1,566,000	5,149,100
	£23,359,000	£80,392,200

Tubes and Fittings

An abridged catalogue of wrought iron, steel, and non-ferrous tubes, with associated fittings, has been issued by Brooks and Walker Ltd. Copies are obtainable from the Company at 47 Great Eastern Street, London, E.C.2.

Metering Device

Liquid Systems Ltd. is now manufacturing and distributing under licence Bowser Xacto Compact units, by arrangement with Bowser International Inc., U.S.A., Bowser International Ltd., London, and Rubery Owen and Co. Ltd., Darlaston.

Basic Bricks

A catalogue giving details of bricks for use in various types of furnaces has been issued by J. G. Stein and Co. Ltd. of Bonnybridge, Scotland.

New Flame-proof Switch

K.D.G. Instruments Ltd. of Croydon, Surrey, have designed a new flame-proof switch for use in dangerous atmospheres encountered in the petroleum industry. The switch has been designed to the requirements of B.S.S. 229.

CRUDE OIL PRODUCTION

	January, 1955 *Brl*
Kern Oil Co. Ltd.:	
California	100,741
Trinidad	80,816
	Tons
Iraq Petroleum Co. Ltd.	1,989,859
Basrah Petroleum Co. Ltd.	458,192
Mosul Petroleum Co. Ltd.	104,836
Kuwait Oil Co. Ltd.	4,244,743
Qatar Petroleum Co. Ltd.	405,447

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Personal Notes

The title, Lord Strathalmond of Pumpherston, has been chosen by **Sir William Fraser,** chairman of The British Petroleum Co. Ltd., on whom a barony was conferred in the New Year Honours List. By his choice Lord Strathalmond has honoured the Scottish shale oil industry. The river Almond flows through the shale fields and "Strath" is a Gaelic derivative meaning "valley".

T. H. Burrell has been appointed to the newly-created position of package co-ordinator for the Vacuum Oil Co. Ltd. He will study the Company's packaging methods in an attempt to simplify and standardize the types and sizes of packages used.

A similar study undertaken by the Socony-Vacuum Oil Co. of New York resulted in large economies by reducing the number of types of packages used within the Socony-Vacuum group and by encouraging standardization in the petroleum industry.

C. R. Young, assistant to the refinery manager at the Esso Petroleum Company's Fawley refinery, has been named as this year's winner of the Society of Engineers' Bessemer Award for one of the outstanding papers presented to the Society during 1954. Mr Young spoke on "Progress in Petroleum Refining" at Burlington House in March last year.

Mr Young joined the Esso Petroleum Company in 1941, and after serving with the Petroleum Warfare Department and the Petroleum Board during the war was appointed process superintendent at Fawley in 1946. He was appointed assistant general refinery superintendent in 1948 and became assistant to the refinery manager in 1951.

J. E. Harvey, general manager of Marine and Industrial Lubricants Ltd., has been appointed to the Board of the Company.

M. W. Boyer has been proposed for election to the Board of Directors of the Standard Oil Company (New Jersey). Mr Boyer is at present executive vice-president of Esso Standard Oil Company.

After working in the research laboratory of applied chemistry at the Massachusetts Institute of Technology, Mr Boyer joined the research affiliate of Standard Oil Company in 1927. He served as general manager for the United States Atomic Energy Commission from 1950 to 1953.

Engine Design as Affected by Fuels and Lubricants*

By C. A. BEARD† *and* D. DOWNS†

PART II—THE COMPRESSION IGNITION ENGINE AND ASPECTS OF LUBRICATING OIL PERFORMANCE

Combustion in the Compression Ignition Engine

Whilst this subject could be further elaborated it is believed that sufficient has been said to indicate the close interdependence of spark-ignition engine design and fuel properties. Although an equally close relationship exists for the diesel engine its progress has not been dependent to the same extent on systematic developments in the quality of the fuel used. The fuel burnt today in high-speed compression-ignition engines does not differ materially from that used during the period of intensive development of this type of unit some twenty-five years ago. The very considerable improvements in the power output and thermal efficiency of the diesel engine since those days have been the result of experimental work, mostly of an *ad hoc* nature, on combustion chambers and fuel injection equipment, with the object of making the maximum use of the air contained within the engine cylinder.

Whereas in gas and petrol engines the fresh charge is virtually a homogeneous mixture of fuel and air which is ignited by a single spark plug, in the compression-ignition engine the charge is composed of air alone with a small proportion of exhaust residuals. This air is compressed to a pressure of about 450 p.s.i. and a temperature of the order of 500°C. Into this hot compressed charge fuel oil must be distributed in roughly 30° of crank angle at full load in such a way that the maximum possible amount of oxygen present is burned efficiently. There lies the problem. Either the air must be taken to the fuel or the fuel must be taken to the air. Out of the large amount of development work which has been carried out on this problem many different types of combustion chamber systems have been evolved and there is space in this article to discuss only some of the more prominent.

Combustion Chamber Design for the Compression Ignition Engine

An important group of engines uses the swirl chamber type of combustion system[1] of which one example is the Comet III shown in Fig 7. A characteristic feature of this chamber is the use of a single fuel jet in conjunction with a rapid rotation of the air charge promoted by means of a tangential passageway into the combustion chamber from the cylinder. The degree of swirl can be adjusted by varying the area of the throat communicating with the chamber. The lower half of the combustion chamber is thermally insulated from the rest of the engine and this "hot plug" serves as a thermal regenerator, receiving heat during combustion and expansion and returning heat to the air during the compression stroke.

This form of combustion chamber gives very good air utilization with consequent high torques and is able to maintain its performance at high engine speeds owing to its good breathing capacity, resulting from the absence of valve masks and the off-set position of the fuel injector which in consequence does not restrict the size of the valves. The minimum fuel consumption is, however, slightly worse than that of the direct injection engine (to be described later), owing mainly to higher heat losses resulting largely from the higher swirl, and starting is in general rather less easy. Against this, the maximum cylinder pressures with the swirl chamber are some 200 to 250 p.s.i. lower than with the direct injection engine and the former is able to use a single jet nozzle, usually of the pintle type which has self-cleaning properties, and relatively modest fuel line pressures. Typical performance curves, under both boosted and unboosted conditions, for an engine fitted with a form of swirl chamber of which the authors have intimate knowledge are shown in Figs 8 and 9. It can be seen that, despite the fact that the engine is driving its own supercharger, the minimum fuel consumption is practically unaltered by boosting.

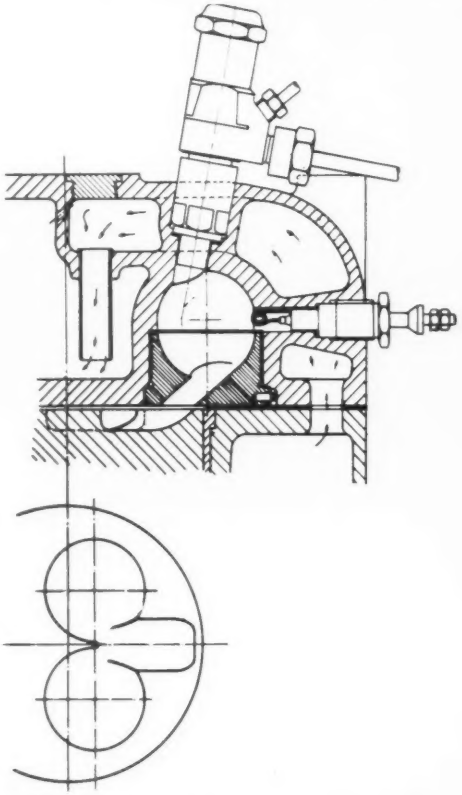

Fig 7. The Comet Mk III combustion chamber.

Considerable improvement in the cold starting properties of the swirl chamber engine resulted from development which

* Paper read to the Institute of Petroleum, London Branch, 1 April, 1954.

† Ricardo & Co. Engineers (1927) Ltd.

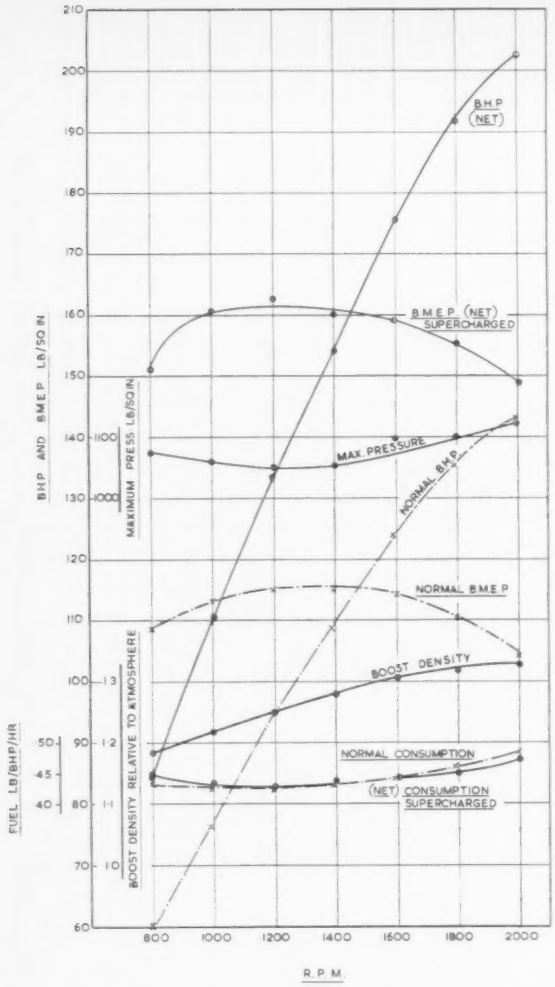

Fig 8. Supercharged 8·8 litre Comet Mk III engine. Performance of engine when driving blower. Blower driven by engine—b.h.p., b.m.e.p., and fuel figures are therefore net figures.

included a temperature survey of the spherical cell of the Comet III combustion chamber. This showed that the hottest zone when motoring was at a radius of half that of the sphere radius and led to the development of a special nozzle which has a small auxiliary hole drilled at an angle to the main spray of the pintle type nozzle. The angle of the auxiliary hole is such that the spray from it passes through the hottest zone of the compressed air charge at starting speeds, so materially assisting cold starting. The quantity of fuel passing through the auxiliary hole is greatest at low speeds and, as the engine speed is raised, the main pintle orifice progressively passes a larger proportion of the injected fuel, while that passing through the auxiliary hole diminishes. This "Pintaux" nozzle, to give it its accepted name, permits a marked improvement in engine starting without penalizing high speed performance. Incidentally, should the small auxiliary hole become blocked starting only and *not* the operating performance is affected.

The direct injection engine in its various forms (Fig 10) uses a much lower degree of air swirl (or rotation) than the swirl-chamber types, and so in general has to use nozzles having two or more orifices, the exact number depending on the degree of swirl present. Obviously, since for a given engine size the maximum fuel quantity required remains constant, the larger the number of fuel jets used the smaller must be the individual hole sizes and consequently the higher the fuel pressure required to obtain the jet velocity necessary for fuel spray penetration and atomization. This means that at high speeds the problem of reliably providing these pressures becomes somewhat difficult. Also, particularly with the smaller size of cylinder, the injector holes are so small that they are very susceptible to blockage troubles caused either by dirt in the fuel or by products of combustion.

To obtain the required degree of air movement in direct injection engines use is made of masked inlet valves, directionally disposed and inclined valve ports, including the use of deflectors to direct the inlet air in a direction tangential to the cylinder axis, thus inducing swirl. In this connexion it should be noted that the approach of the air to the cylinder head passages can be profoundly affected by the shape of the induction pipe and manifold, if used.

Whilst in this rapid survey of the diesel engine attention has been concentrated on the high-swirl and direct-injection types which represent most of the combustion chamber forms in use in the U.K., other types exist which are more popular on the Continent and in the U.S.A. These are the precombustion chamber types (such as the Mercedes-Benz and Caterpillar), and the air-cell chambers such as the Acro and Lanova.

Mechanical Design of the Compression Ignition Engine

The principal mechanical difference between the petrol engine and the diesel is the need in the latter case for more robust parts to resist the higher working pressures. This is coupled with the need to cope with higher local heat flows since, although the thermal efficiency of the diesel is higher than that of the petrol engine, the higher charge density coupled with the use of air movement leads to greater local heat flows.

Perhaps the part which has received the greatest care and attention is the piston. Today practically all diesel engine pistons are made of light alloys, usually Y-alloy or a 12 per cent silicon alloy having a lower coefficient of expansion. As is well known these aluminium alloys fall off in strength as

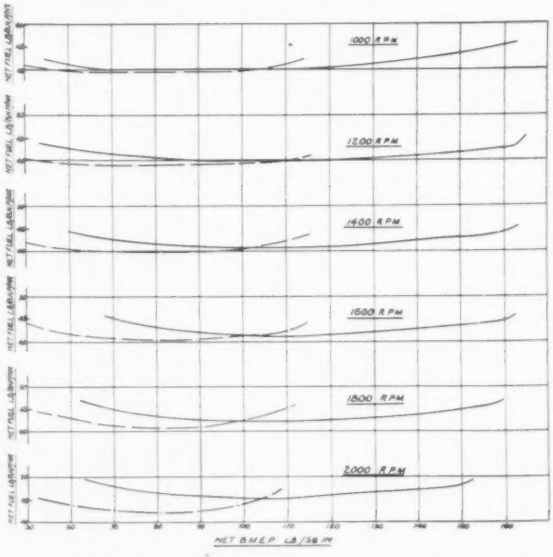

Fig 9. Supercharged 8·8 litre Comet Mk III engine. Mixture range loops, boosted and unboosted.

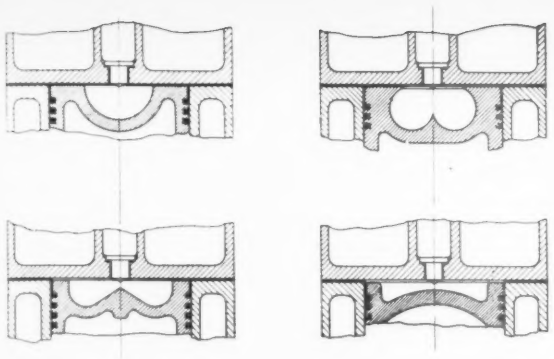

Fig 10. *Various types of direct injection combustion chamber.*

the temperature is raised so that every attempt must be made to keep the temperature as low as possible and the loading of the gudgeon pin bosses down to about 5700 p.s.i. projected area^2. The techniques of piston temperature measurement, previously referred to, together with production methods of machining pistons to the required profile have done much to bring down operating temperatures. At the same time the provision of thicker scantlings, not only for strength but also to reduce distortion and to facilitate heat flow to the piston skirt, have done much from the internal side of the piston to reduce temperatures and to permit piston rings to operate on lands which do not distort under load. The formation of gummy deposits owing to the presence of carbon and partly burned fuel, resulting from poor combustion, and oxidation of the oil at high temperature, makes ring sticking and packing a very real problem in oil engines if the top ring groove temperature exceeds about 200–210 C. The use of modern detergent oils raises the maximum permissible groove temperature, but the exact figure which can be tolerated depends on the nature of the oil and the fuel as well as on the engine design and operating condition. Hence the need to keep piston temperatures low.

By the above piston design factors and the provision of an adequately vigorous water circulation around the cylinder liners it is now possible to cool pistons sufficiently to avoid piston ring troubles during long runs at outputs of 1·5 b.h.p. per square inch of piston area.

Engine design is never static since the customer is always ready to accept all that is provided and then to make new demands. Higher outputs are readily obtained by boosting since no fuel quality factor sets a limit analogous to that set by detonation or pre-ignition in the petrol engine. Indeed, quite a small amount of supercharging, by a reduction in ignition lag, leads to marked decrease in diesel knock. As an example of lack of fuel sensitivity, an experimental Comet III engine has been operated at intake pressures of 2 atm (gauge), givingan ouput of 320 p.s.i. b.m.e.p. (gross) on the standard commercially obtainable diesel fuel. The compression ratio used was 10 to 1, since in this case the general engine structure would not permit the use of maximum cylinder pressures in excess of 1200 p.s.i.

The obtaining of higher outputs by supercharging is slowly spreading and many engines are already on the market using about half an atmosphere of boost, the blowers used being of the Rootes or the centrifugal type. Many centrifugal blowers are now driven by means of exhaust turbines so that the blower horsepower is provided at the cost of a moderate increase in exhaust back pressure only. A new design of positive-displacement supercharger is currently being developed by Sir Harry Ricardo with the automotive application particularly in mind. It does not have the disadvantage of the Rootes type of a large leakage path and inefficiency at low r.p.m., and so provides a good torque at low speeds, a characteristic ideal for traction purposes.

To obtain satisfactorily low piston temperatures for prolonged operation with these higher outputs it is becoming necessary to use some form of oil cooling to supplement the usual cooling via the rings and lands to the cylinder. Typical forms of piston using cooling oil passed up a drilled hole in the connecting-rod from a timed feed through the big-end bearing are shown in Figs 11 and 12.

The first figure shows a design in which a spring-loaded collector bearing on the top of the small end eye conveys oil directly into the piston. The realization that very high piston accelerations in conjunction with the inertia of the oil make the use of a mechanical connexion unnecessary led to the design of the form of cooling shown in Fig 12.

Cetane Number of Diesel Fuels

Most attention has been devoted so far to the design aspects of diesel engine performance and this is only natural because of the preponderant influence of mechanical and physical factors in diesel engine performance. The characteristics of the fuel are not, however, without their importance and probably the most significant of these is ignition quality, expressed as cetane number.

The combustion characteristics of a good diesel fuel are the exact opposite of those of a good petrol, ease of ignition rather than resistance to spontaneous combustion being required. In fact there is a reciprocal relationship between

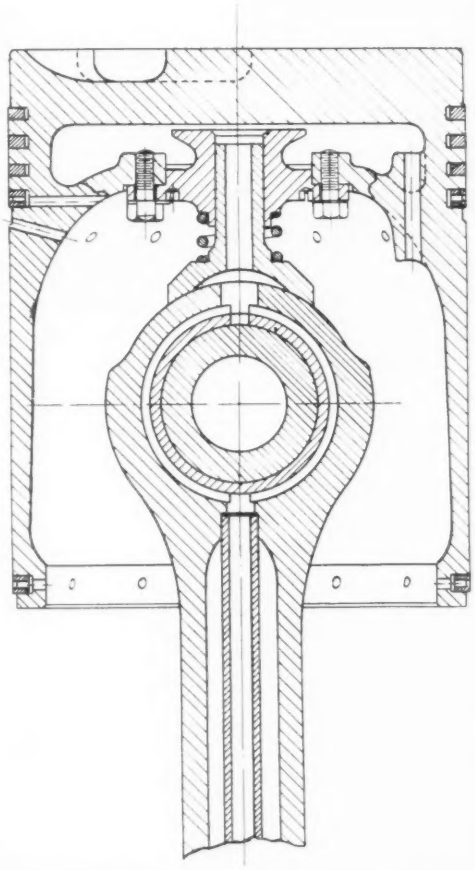

Fig 11. *Oil-cooled piston with spring-loaded collector.*

cetane number and octane number. A fuel of good ignition quality—high cetane number—gives not only easy starting but also smoother and less noisy operation at speed. This is because smooth combustion depends on the fuel becoming ignited shortly after the start of the injection so that after the initial ignition the rate of combustion depends on the rate of fuel injection. When a fuel of low ignition quality, which requires an appreciable induction time interval for ignition, is used a considerable quantity of fuel has been injected into the combustion chamber before ignition takes place and the spontaneous combustion of this fuel with the consequent rapid rate of pressure rise gives the characteristic noise of diesel knock.

In general, petroleum refiners do not seem to have much difficulty in producing a fuel of 45–50 cetane number, which is sufficiently high for satisfactory operation in most high speed diesel engines today. In fact the diesel fuels marketed in the U.K. which have been obtained from Middle East crudes often have cetane numbers of 55 to 58. In the U.S.A. the figures may be somewhat lower and some refiners are alleged to have difficulty in meeting the minimum cetane number specification of 50 of the American railroads. Ignition accelerators to improve the cetane number of diesel fuels exist but in general the quantities required are large, making

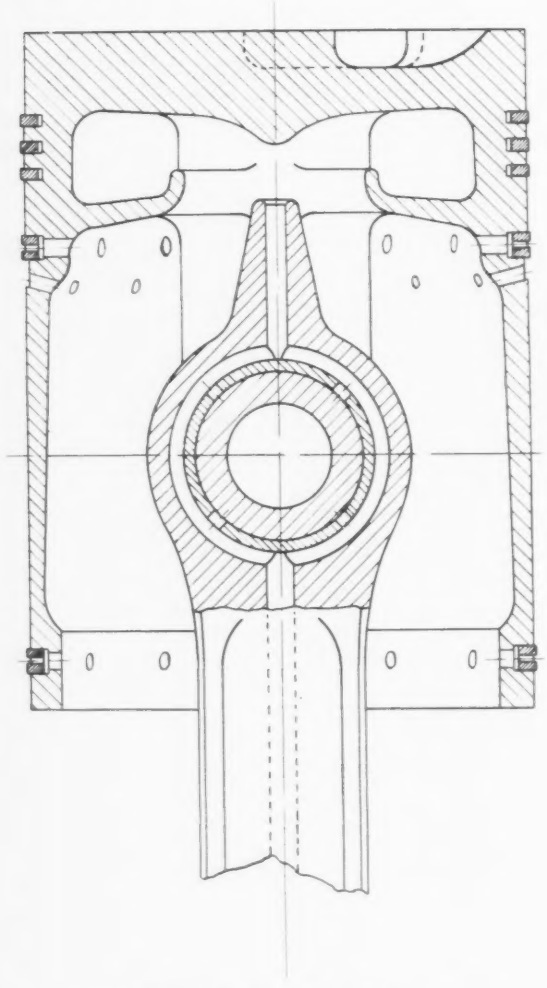

Fig 12. *Cocktail-shaker piston.*

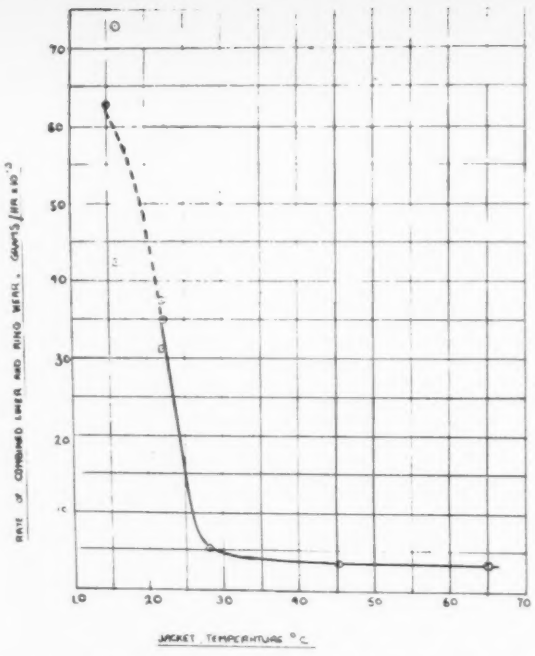

Fig 13. *The effect of coolant temperature on cylinder wear.*

the process costly, and the improvements to be obtained do not appear to warrant the expense involved.

Sulphur Content of Diesel Fuels

The increasing use of diesel fuels from the Middle East, which contain some sulphur in their molecular make-up, has led to one of the main diesel engine problems directly ascribable to fuel. This is the wear of cylinder liners and piston ring grooves as a result of corrosion. During combustion the sulphur atoms are oxidized to sulphur dioxide and trioxide which combine with the steam present to form sulphuric acid. If at any time during the engine cycle the cylinder temperature falls below the dew point of these sulphur compounds corrosion takes place. The effect of cylinder coolant temperature on corrosion is strikingly illustrated in Fig 13. It is recognized that much can be done to reduce corrosion troubles by operating with high water-jacket temperatures and, in the case of vehicle engines particularly, arranging to have a thermostat in the circuit to ensure a rapid warm-up period.

Chromium-plated liners are not proof against sulphur corrosion since chromium is itself readily attacked by sulphuric acid. To avoid trouble it is necessary to operate with a cylinder liner temperature exceeding the dew point of the sulphur compounds formed and experiments have shown that the critical temperature is in the region of 120 C. The present trend is to use a high phosphorus cast-iron cylinder liner in conjunction with hardened rings, the top gas ring sometimes being chromium-plated. This is permissible since the top ring operates at temperatures above the dew point for the sulphur compounds. Aluminium pistons are often made with cast-in iron ring inserts to avoid groove wear owing to corrosion. An alternative palliative which has been used is to fit thin chromium-plated rings at the bottom face of the ring groove between the ring and the groove.

The Use of Heavy Diesel Fuels

A feature of the postwar marine diesel engine field has been the increasing use of heavier grades of fuel which are, of

course, much cheaper than the lighter distillate fuels. Such fuels are also being used for the smaller higher speed engines fitted as auxiliary units to ships and power stations. The rather high ash and asphaltene as well as the sulphur contents of these fuels give rise to wear problems and, particularly in the case of direct injection engines, to the formation of "trumpets" of carbon around the nozzle orifices. There is already a vast literature on this subject and comment will therefore be confined to a matter of which the authors have personal experience, that is the big improvement in combustion which is obtained, particularly with the heavier fuels, at low. Some of the increase in viscosity may, however, be illusory as such additive oils are non-Newtonian, *i.e.* their viscosity is dependent on the rate of shear, and under conditions of high rate of shear, such as in an engine bearing or between the piston ring and the cylinder, their relative viscosity may be lower than that determined by a viscometer of the Redwood or Saybolt type.

Despite this and because of the improvement in engine efficiency as a result of the lower friction loss, the use of low viscosity oils is increasing. SAE 10W oils are becoming quite common and the Esso Petroleum Company has reported

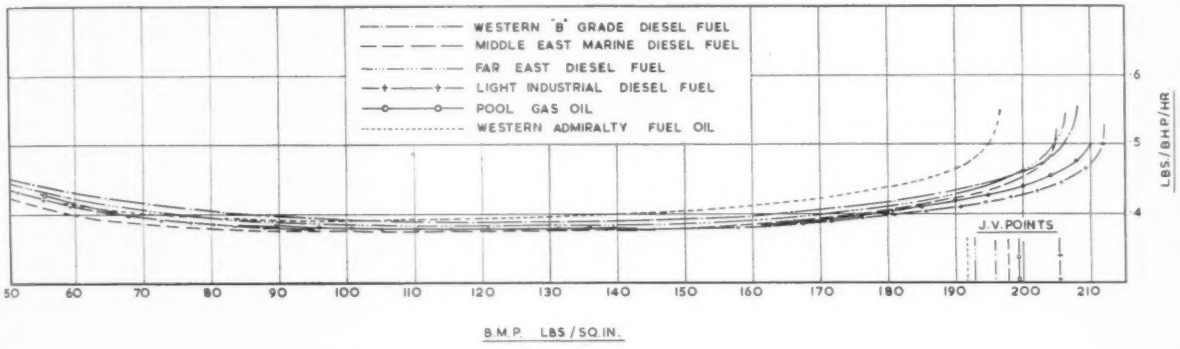

Fig 14. *Mixture range curves on various fuels.* 1250 *r.p.m.* 20 *inch Hg Boost* 30°*C I.A.T. Maximum pressure limited to* 110 *p.s.i. at* 150 *p.s.i. b.m.e.p.*

when a modest amount of supercharge is used. Fig 14 shows the closely similar engine performance obtained with a wide variety of fuels when an engine fitted with a swirl chamber combustion system is boosted to a pressure of 10 p.s.i.[3] It may be that developments along these lines will open the way to a wider use of heavier fuels.

Lubricating Oils of Low Viscosity

Although discussion of the lubricating oil has been left to the last this does not mean that it is the least important of the factors involved in engine design. Nowadays oil is used not only for lubrication pure and simple but also for cooling of rubbing parts and for the distribution throughout the engine of active agents to minimize wear, corrosion, oxidation, and fouling of the engine by combustion chamber deposits. In general any well-refined mineral oil will provide a level of intrinsic lubrication quality adequate for engine operation and the physical property of the oil which has most influence on its behaviour in the engine is its viscosity. This should be as low as possible in order to minimize power losses owing to viscous friction and to give ease of starting under cold conditions. Since the viscosity of the lubricating oil decreases with temperature, it may be found that a lubricating oil which has a viscosity sufficiently low to give good starting at low ambient temperature has too low a viscosity at the operating temperatures for the engine bearings, pistons, and liners when under load. If the viscosity of the oil is too low at engine operating temperatures, it can lead to wear and scuffing troubles owing to the thinness of the oil film and the fact that some of the long chain molecules which would give good boundary lubrication have been removed in the refining process. The lubricating oil consumption may also increase. One answer is to produce oils which have flat viscosity-temperature curves, *i.e.* high viscosity indices. This can be achieved either by refinery development or by the incorporation of additives—called viscosity index improvers—in the oil. These additives are very long chain molecules—their molecular weight may be as high as 100,000—which increase the viscosity of the oil, much more at high temperatures than some tests using SAE 5W oils on their own fleet of vehicles where a gain of 14·5 per cent in fuel consumption was obtained as compared with SAE 30 oil[4]. Oil consumption was also increased but wear does not appear to have been a problem. This was probably because additive lubricating oils were used. Wear figures show that, although the wear with an SAE 10W oil is higher than that with an SAE 30 oil, the use of additives can reduce the wear figures of the thin oil below those of the untreated SAE 30 oil and to a level not much higher than that of the SAE 30 oil with additives[5].

Additive Lubricating Oils

The increased power outputs, particularly of diesel engines, resulting in increased heat flows, and the use of high sulphur diesel fuels which increase both the deposit and the corrosion problems have led to the development of oils containing anti-oxidant, detergent, and anti-wear additives. Oxidation inhibitors are added to resist chemical changes in the oil which occur during engine operation to form destructive acids. Corrosion preventives offset corrosive action on alloy bearings and other metal parts of the engine by forming a protective film through which corrosive acids cannot pass. Detergents keep engine surfaces clean and prevent the deposit of sludge. Dispersants keep potential sludge-forming insolubles in suspension and prevent their deposition on engine parts. In general only an anti-oxidant with perhaps a small quantity of detergent is required with a gasoline engine. If the sulphur content of diesel fuel were not more than 0·3 to 0·4 per cent it is probable that this would be all that would be required for the compression ignition engine also, but with the sulphur contents of current gas oils averaging 0·8 to 1·0 per cent, cylinder bore lacquering and ring sticking increase so much and cylinder bore wear becomes so marked, largely owing to sulphuric acid corrosion, that greater additive quantities are required to give satisfactory operation. A further advantage of the modern additive oils is that they, in general, eliminate corrosion difficulties with the harder big-end and main bearing materials, the adoption of which has

been dictated by the high loadings. Copper-lead, which with sufficiently high oil and engine temperatures can be corroded quite rapidly with a straight mineral oil, is uncorroded when an additive oil is used under the same conditions. A secondary disadvantage of some additive oils is corrosion of phosphor bronze small-end bearings where these run at a temperature sufficiently high to decompose the lubricating oil additive. A silicon bronze alloy has been found to be much more resistant to this form of attack.

This necessarily somewhat brief survey of the influence of fuel and oil characteristics on engine design and performance has probably been enough to show their close interdependence. Further progress will be made only by close collaboration between the engineer and the petroleum technologist. This was never more important than at present when in the case of the spark-ignition engine there is a wide field open for reducing the harmful effects of combustion chamber deposits and, in the case of the diesel engine, there is a demand from users for an engine which will burn a wider range of fuels. Further developments in engine design, fuel treatment, and lubricating oil composition are necessary and present a challenge to the engine designer and petroleum technologist.

Acknowledgement

The authors are indebted to Messrs Ricardo and Company Engineers (1927) Ltd. for permission to publish this paper.

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E.U.R. and the Congress Building

VENUE OF THE FOURTH WORLD PETROLEUM CONGRESS

Rome's Universal Exhibition Centre, where the Fourth World Petroleum Congress is to take place in June this year, was first planned many years ago before the second world war. A group of Italian architects planned to build a new "city" for the Universal Exhibition of Civilization to take place in 1942 but their scheme was interrupted when half complete by the intervention of the second world war.

It had been decided that the exhibition buildings should be permanent, to form a new quarter of Rome, but for years following the outbreak of war the wholly or partially built structures were abandoned.

It was not until 1952 that work was begun to complete the project. Since then many miles of roadway and many residential buildings have been constructed, two museum collections have been opened in the Roman Civilization Museum and the Ethnographic Museum, and the Italian Civilization Building and the Congress Building have been completed.

The Congress Building, which will be the centre for the Fourth World Petroleum Congress, is considered to be one of the most interesting modern buildings in Rome. Its main rooms consist of a reception room, a hall where delegates may meet and talk privately, and the Aula Magna where plenary sessions will take place. The Aula Magna has seating capacity for one thousand delegates, good acoustics, and is fitted with equipment for simultaneous translation into different languages. Adjoining galleries will house information and reception offices and other important services.

The Congress Building.

The Civilization Building.

Rooms on the upper floor of the building will be used for section meetings and special gatherings.

A park surrounding the Congress Building, and a roof terrace, will be convenient for recreation, and there is a large restaurant near the main building.

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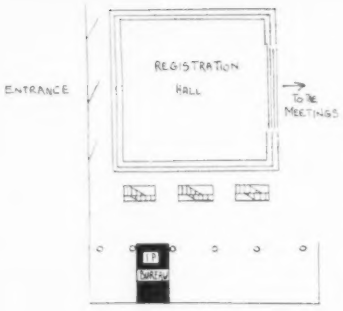
CONGRESS LECTURE ALTERATION

A lecture on "Major Oil Developments" which was to have been given by C. A. P. Southwell at the Fourth World Petroleum Congress will not now take place.

The lecture was to have been included in a programme of four lectures of general interest. In its place a lecture entitled "The Evolution of Oil Exploration" will be delivered by P. T. Cox, M.B.E., M.A., exploration manager and chief geologist of The British Petroleum Co. Ltd.

The Institute of Petroleum Bureau at the 4th World Petroleum Congress



Some time before the 3rd World Petroleum Congress, the General Secretary of the Institute suggested to the British National Committee that in order to have somewhere to display the varied literature published by the Institute, a stall or bureau might be set up in some corner of the Palace Hotel. It was also suggested that some English-speaking visitors might like to escape from the hurly-burly around the official enquiries desk and use the I.P. bureau for this purpose instead. This suggestion was approved and an Institute of Petroleum Bureau was set up.

As this was a new idea, and time was short, the bureau was necessarily a somewhat impromptu affair, although the major oil companies provided a small photographic display, and a splendid palm tree, which the General Secretary stole from the main lounge, gave it a slightly tropical air. In spite of its shortcomings, however, there was no doubt that I.P. members appreciated the small services the bureau was able to provide, and over twenty new members were recruited during the Congress.

The Council of the Institute has decided once again to run a bureau at the 4th Congress in Rome, but this time it will be a bigger and, it is hoped, better affair, and all English-speaking members of the Congress are most cordially invited to visit the bureau and make use of its information centre.

The bureau will be situated on the right of the entrance to the main registration hall, just off the main floor itself, as shown on the plan, and it is hoped to provide a full information service covering the Congress itself, what to see and do in Rome and the surrounding country, how to get there, and how much it will cost.

There will be full details of excursions and of the Exhibition of Petroleum Equipment in Naples.

The General Secretary spent some time in Rome during the war, and if any members require information or help, the Institute staff will do its utmost to provide the answers.

The British oil companies have very kindly provided photographs for display on the stand, and members are invited to use the bureau as a meeting place with their friends.

The IP Bureau at the 3rd World Petroleum Congress.

* * *

Petroleum in Parliament

Oil Tankers

The Minister of Transport and Civil Aviation was asked on 1 February if he was aware that the number of oil tankers ordered in 1954 was less than it had been for several years. The questioner drew attention to the large quantity of British oil that was being carried by foreign-owned vessels, and asked what steps were being taken to provide sufficient British tankage to carry this oil.

Mr Boyd-Carpenter said in reply that the demand for new oil tankers had lessened and that this accounted for the latest fall in orders. There was enough British tonnage to carry all United Kingdom oil imports but much of it was employed in other trades. The most economic use of these fleets, which earn valuable foreign exchange, could safely be left to the oil companies themselves, and it was not the policy of Her Majesty's Government to intervene.

Petrol and Oil Prices

On 7 February, the Minister of Fuel and Power was questioned on the fact that prices of the oil industry's products are based on an index of Gulf prices. The bulk of the oil was obtained elsewhere, the questioner stated, and he asked if the Minister would institute price control on petrol and oil so as to protect the motorist and public transport services against excessive prices.

In reply, Mr Joynson-Hicks said that oil was largely an international trade and it was unavoidable that United Kingdom prices should be influenced by the Western Hemisphere market. With regard to price control, competition provided protection against excessive prices.

Government Holding in BP Company

Answering questions about the Government's share holding in The British Petroleum Co. Ltd., the Chancellor of the Exchequer gave the following details: "In 1914 the Government subscribed for two million £1 ordinary shares and one thousand £1 preference shares at par and, in 1919, for a further three million £1 ordinary shares at par. Bonus issues of ordinary shares received in 1926, 1937, and 1954 have totalled 51,250,000 and have brought the nominal value of the Government's holding to £56,250,000 ordinary stock and £1000 preference stock. The value of the Government's holding at close of business yesterday (14 February) was just over £233 million."

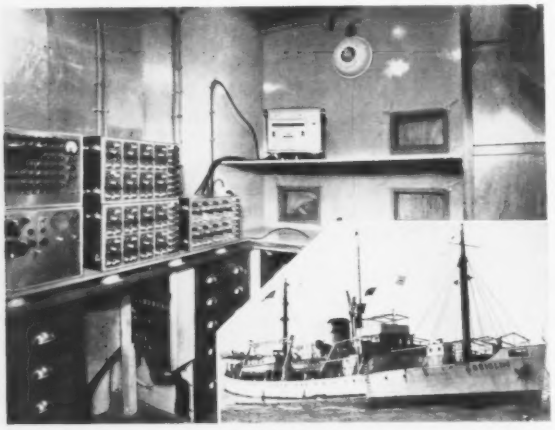
The Government's use of its powers as shareholders in The British Petroleum Company was discussed as a result of a question put to the Chancellor of the Exchequer on 1 March. Mr R. A. Butler stated that under the Articles of Association two directors were appointed by the Treasury to watch over the interests of Her Majesty's Government. It had not, however, been the practice of the Government to interfere with the commercial management of the Company.

This raised the question as to whether the Government, if it were retaining its shares in the Company, should not take some share in its direction and management. In reply, Mr Butler stated that current practice in this matter had operated since 1929.

Notes of the Month

Seismic Survey Vessel

S.s. *Seislim*—believed to be the first British ship to be fitted out specifically for single boat marine seismic exploration—sailed recently on her first assignment. The 1055-ton vessel is owned by Seismograph Service Ltd., geophysical consultants, and it is expected that she will see service in many parts of the world.



Interior of the recording cabin showing the test panel (top left), *the control panel* (bottom left), *and* 24 *amplifiers in three cases. Top centre is a recording camera which feeds the photographic paper direct into the dark room beyond.*

Inset picture shows s.s. Seislim *in the Thames Estuary, waiting to load explosives for her first assignment.*

Seislim carries a total of 60 personnel and is specially equipped for her work. Speed of operation and the ability to remain at sea for the maximum time when the weather is suitable are of great importance. For this reason the *Seislim* is equipped with a heliport so that seismograms can be collected in the minimum of time without the ship returning to port. Special winches mounted on the ship make it possible to handle the submerged equipment so that shooting and recording operations can continue without stopping the vessel.

An electronic phase system is used to position the ship in the areas of operation, and depth-sounding devices and radar are also fitted.

Two shallow-draught, 40-ft, 100-h.p. diesel motor launches are carried by the *Seislim* for work in shallow waters.

Du Pont Manufacture T.E.L.

A site near Antioch, California, has been chosen by the Du Pont Company for the manufacture of tetraethyl lead and "Freon" fluorinated hydrocarbons for refrigeration, etc.

The new plant will supply the growing needs of the West Coast petroleum industry and of the expanding air-conditioning, refrigeration, and aerosol industries also situated on the West Coast.

Crude Production Increases

Reporting considerable increases in Middle East production of crude oil during 1954, The British Petroleum Company gives the following statistics: Kuwait, where BP has a 50 per cent interest, produced 46,969,415 tons compared with 42,603,244 tons in 1953; the Iraqi fields of the Iraq Petroleum Co. Group, in which BP is a partner, produced 29,606,747 tons compared with 27,220,199 tons in 1953; and the Qatar field of the Qatar Petroleum Co.—a member of the Iraq Petroleum Co. Group, produced 4,704,423 tons compared with 3,997,926 tons in 1953.

In South Iran, where The British Petroleum Co. has a 40 per cent interest in oil operations, some 1,400,000 tons were produced between the end of October and the close of the year.

Expansion at Sunbury

A new engine laboratory is being built, at a cost of approximately £85,000, at The British Petroleum Company's research station at Sunbury-on-Thames. It is expected to be in full operation by April next year.

The laboratory will be used for the testing of motor fuels and lubricating oils and will include a chassis dynamometer room where road conditions can be reproduced.

In this room it will be possible to mount a car on rollers and to study, under varying conditions, the strain on the engine and the qualities of the motor fuel and lubricating oil used. Temperature, wind force, and air humidity will be easily adjustable and it will be possible to simulate varying motoring conditions such as hill climbing or level driving.

The laboratory will include facilities for testing agricultural tractors, two beds for testing production car engines, and a car overhaul bay for servicing cars used at Sunbury for actual road testing.

New Indian Refinery

Nearly half of India's petroleum requirements will be met in future by a new oil refinery on Trombay Island, Bombay. The refinery is owned by Burmah-Shell Refineries Ltd., and is the largest in India, with a yearly capacity of two million tons.

The refinery processes crude oil from the Middle East and is expected to be in full production within a few months.

Under-water Oil Well Off Qatar

Drilling has begun in the sea-bed of the Persian Gulf off Qatar. The work is being carried out by Shell from a 1900-ton movable island which was recently moved into position.

Exploration rights over a large area of the Persian Gulf were acquired from the Ruler of Qatar at the end of 1952, and preliminary surveys have led to the selection of this first drilling location.

Kwinana Refinery Comes On-stream

On 1 February, The British Petroleum Company's new 3,000,000-tons-a-year refinery at Kwinana, Western Australia, came on-stream when the first of two distillation units was commissioned. The remaining units were scheduled to come into operation during February and March.

Kwinana refinery is the largest oil refinery in operation in Australasia and was built at a cost of about £30 million. It will be operated by Australasian Petroleum Refinery Ltd.—one of British Petroleum's Australian associates.

Lord Strathalmond, chairman of The British Petroleum Company, has expressed to the Honourable A. R. G. Hawke, Premier of Western Australia, his appreciation and thanks for the co-operation received from officials of the Western Australian Government.

BP Continental Refineries' Output

There was an increase of over 600,000 tons in the quantity of oil processed during 1954 by the six Continental refineries operated by The British Petroleum Company and its associates. The provisional figure for 1954 is 8,623,000 tons compared with 7,995,000 tons in 1953.

Higher throughput at the two Hamburg refineries and at Porto Marghera refinery, Venice, owned jointly by BP and Azienda Generale Italiana Petroli, was largely responsible for the increase. The highest throughput for the year was at the Lavera refinery of BP's French associate, Société Française des Pétroles BP.

Iranian Oil

Production and refining figures issued recently by Iranian Oil Participants Ltd. give details of the work of Iraanse Aardolie Exploratie en Productie Maatschappij (Iranian Oil Exploration and Producing Co.) N.V., and Iraanse Aardolie Raffinage Maatschappij (Iranian Oil Refining Co.) N.V.

Production of crude oil in South Iran by the first of these companies during the period 29 October to 31 December 1954 amounted to 1,400,000 long tons, and production for the month of January 1955 was 929,000 long tons—a daily average production for January of 227,000 barrels a calendar day.

The refining company had a throughput at Abadan of 898,000 long tons for the period 29 October to 31 December 1954, and 636,000 long tons for January 1955—a daily average refinery throughput for January of 151,000 barrels a calendar day.

New Directors

Appointments to the Boards of these two Companies were announced recently. Fathollah Nafisi, J. J. O'Brien, B. Scheffer, Abolghasem Shiva, and E. E. Thorneloe have been appointed directors of Iraanse Aardolie Exploratie en Productie Maatschappij, and Dr Reza Fallah, Manuchehr Farmanfarmaian, M. Hagen, D. C. Hussey, and E. E. Thorneloe are now members of the Board of Iraanse Aardolie Raffinage Maatschappij.

L. E. J. Brouwer is chairman and general managing director of both companies.

C.I.S. Lecture on "Oil"

Lieut.-Col. J. W. Chitty, M.B.E., F.C.I.S., assistant secretary of the Iraq Petroleum Co. Ltd., is to lecture on "Oil" at the 1955 annual conference of the Chartered Institute of Secretaries.

Iraq Crude Production Records

Record crude oil production figures were reached by the Iraq Petroleum Company and its associated companies in 1954.

The Iraq Petroleum Company produced 23,731,108 tons of crude compared with 22,865,538 in 1953 Basrah Petroleum Company produced 4,592,196 tons compared with 3,077,522, and Mosul Petroleum Company produced 1,283,443 tons compared with 1,277,139.

TEL Exports from U.K.

During 1954 the U.K. exported 3,374,584 gallons of TEL anti-knock compounds, valued at £7,214,777 c.i.f. The corresponding figure for 1953 was 1,084,935 gallons, valued at £2,502,312.

Nahorkatiya—Digboi Pipeline

In November last year a pipeline between the Assam Oil Company's oilfield at Nahorkatiya and the Digboi refinery was opened by Assam's Chief Minister, Sri Bisnuram Medhi. The pipeline, which is eight inches in diameter, runs 23 miles through thick jungle.

Drilling activities are progressing at Nahorkatiya. Well No. 4 has been successfully tested for production and output from it is expected to equal that of the first three wells in this area—each of which is capable of producing 500 barrels or more of crude oil daily.

A fifth well is being drilled at Nahorkatiya and work is scheduled to begin on a sixth well in the near future.

Shell Win French Advertising Award

L'Oscar de la Publicité—the French advertising award for the best publicity campaign in France each year—was presented to Société des Pétroles Shell Berre, one of the Royal Dutch/Shell Group of companies, for their publicity work during 1954.

The Oscar is awarded to the firm whose campaign has been most notable for the honesty of its claims, its technical quality, and originality. Making the award, the judging panel praised the dynamic and educational nature of the campaign and the imaginative quality of its presentation.

Domestic Oil Burning Equipment

An exhibition of domestic oil fuel appliances was opened recently at Charringtons' showrooms at 11 Henrietta Place, London, W.1. A representative selection of equipment is on view and advice is readily available to aid the householder in his choice.

Charringtons' experience in the use of all types of fuel and their interest in oil, as sole distributors over a wide area of fuel oils produced by the Vacuum Oil Company, should help the customer to decide on the relative merits of liquid and solid fuels for use in homes and institutions.

Fire-fighting Equipment

New appliances designed and manufactured by the Pyrene Co. Ltd. are of particular interest to the oil industry.

One is the PDU 25 dry-chemical extinguisher which has been designed for quick action in smothering fires involving petrol, oils, alcohols, etc., and is said to be especially effective against "running" fires fed by flowing inflammable liquids.

A B.P. photo

Chambord, *the first of three 33,000-dwt oil tankers which are being built for The British Petroleum Company's associate, Société Française des Pétroles BP. The new tanker was launched at Dunkirk and named by Mme Delmas, wife of the French Minister of Transport.*

Another new appliance is the portable FB 10X foam-making branchpipe, suitable for fighting fires of highly inflammable materials when there is a limited supply of water—for example when a water tender is being used.

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FIFTH WORLD POWER CONFERENCE

Details of the technical programme to be covered at the Fifth World Power Conference, which is taking place in Vienna from 17 to 23 June 1956, are contained in a pamphlet issued recently by the Austrian National Committee.

The theme of the Conference is World Energy Resources in the light of Recent Technical and Economic Developments, and a British Papers Committee has been set up by the British National Committee to make arrangements for the preparation of British papers within the scope of the programme.

Among the members of the British Papers Committee are F. N. Beaumont of The British Petroleum Co. Ltd., J. A. Oriel, C.B.E., M.C., of The Shell Petroleum Co. Ltd., Dr A. Parker, C.B.E., director of fuel research, DSIR, and K. T. Spencer, C.B.E., M.C., chief scientist, Ministry of Fuel and Power.

Communications to the British Papers Committee should be addressed to The Secretary, British National Committee, World Power Conference, 201–2 Grand Buildings, Trafalgar Square, London, W.C.2.

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ROYAL SOCIETY OF ARTS PRIZES

Among the prizes to be awarded by the Royal Society of Arts during 1955 are two of particular interest to industry. They are the Howard Prize of £50 for a treatise on some aspect of mechanical motive power, and the Benjamin Shaw prize of £20 for the promotion of industrial safety.

The Benjamin Shaw prize will be awarded "for any discovery, invention, or newly-devised method of obviating or materially diminishing any risk to life, limb, or health, incidental to any industrial occupation, and not previously capable of being so obviated or diminished by any known and practically available means". Entries may be in the form of descriptive essays or models.

Entries for these prizes must be received by the Secretary of the Royal Society of Arts, 6–8, John Adam Street, Adelphi, London, W.C.2. not later than 31 July.

This model of the oil tanker "Vacuum Pioneer" was shown recently in a children's television programme on oil tankers. Shown here are Captain Girling of Socony-Vacuum Overseas Supply Company (left) *who used the model to explain the design of an oil tanker, and Edward Andrewes who devised the programme.*

Forthcoming Meetings

THE INSTITUTE

(*At 26 Portland Place, London, W.1, 5.30 p.m.—tea 5 p.m.*)

Refining Methods for Maximizing Middle Distillate Production. L. S. Bonnell. **13 April**

Evaporation Losses from Petrol Storage Tanks in Great Britain—A Practical Survey. E. H. Walker, B.Sc., A.R.I.C.; R. M. Eltringham, B.Sc.: and A. Puttick, M.Sc., A.R.I.C. **11 May**

IP FAWLEY BRANCH

(*At Esso (Fawley) Recreation Club, Holbury, 7.30 p.m.*)

Farnborough Air Displays. R. Du Cane. **15 April**

IP LONDON BRANCH

(*At 26 Portland Place, London, W.1, 6 p.m.—tea 5.30 p.m.*)

Petroleum and Fire Prevention—Some Special Considerations. J. H. Burgoyne, D.Sc., Ph.D., A.R.C.S., D.I.C. **20 April**

Branch Forum. **17 May**

IP NORTHERN BRANCH

(*At Engineers' Club, Albert Square, Manchester 2, 6.30 p.m.*)

Drawing Oils and Lubricants. A. B. Ashton, M.Sc., F.I.M. **19 April**

IP SOUTH-EASTERN BRANCH

(*At King's Head Hotel, Rochester, 7.45 p.m.*)

Supervisory Training. W. Hockney. **3 May**

IP STANLOW BRANCH

(*At the Grosvenor Hotel, Chester, 7 p.m.*)

Engineering in Chemical Plants. O. W. Murray. Joint meeting with The Institution of Chemical Engineers and the Society of Chemical Industry. **13 April**

ECONOMICS AND OPERATIONS GROUP

(*At 26 Portland Place, London, W.1, 5.30 p.m.—tea 5 p.m.*)

Trends in Motor Vehicle Population and their Effects on Petroleum Consumption. W. A. C. Strugnell. **19 April**

★ ★ ★

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Air Ministry Works Designs Branch requires in London designer/draughtsman for bulk petroleum storage and pumping installations experienced in one or more of following:— (*a*) storage tank layout and design (*b*) pumphouse and plant layout (*c*) development of pipeline schemes (*d*) hydraulic calculations. Technical training to O.N.C. standard required. Salaries up to £695 p.a., starting pay based on age, qualifications, and experience. Overtime payable. Promotion prospects, and long term possibilities. Natural-born British subjects only. Write stating age, qualifications, employment details, including type of work done, to Ministry of Labour, 236 Walworth Road, London, S.E.17., quoting Order 3593/EC.

The British Petroleum Company Limited require a **Training Superintendent** for their modern Petroleum Refinery in Kent. Responsibilities will include supervision of: Apprentice Training at all levels; Job Training in Crafts and Process work; Supervisor Training; and Further Education. The successful candidate must be a corporate member of a recognized professional body, and preferably a University graduate. He must have a successful record in Industrial Training, though not necessarily in all the branches listed above, and must be capable of applying Training Method to a wide field of activities. The Training Superintendent will work in conjunction with Training Officers in other establishments of the B.P.C. group of Companies. Salary according to qualifications and experience. Apply Manager, Recruitment Branch, Box 7397, c/o 191 Gresham House, E.C.2.

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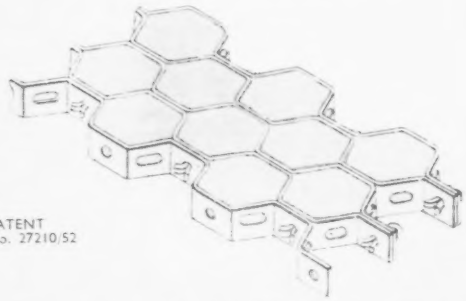

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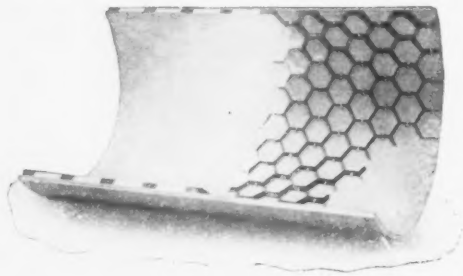

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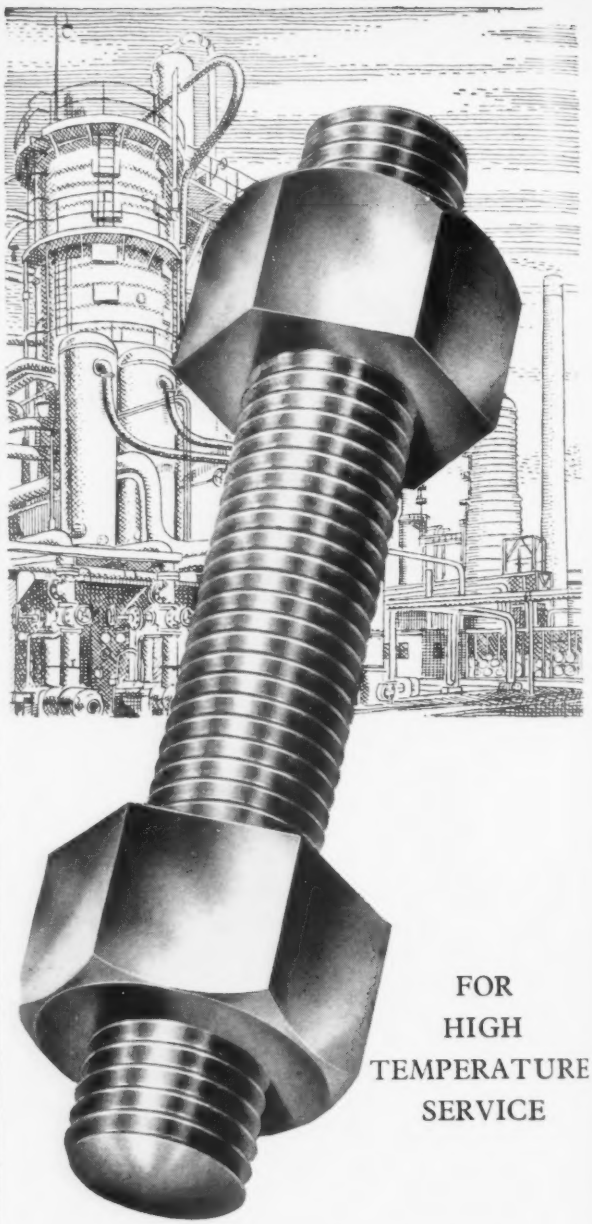

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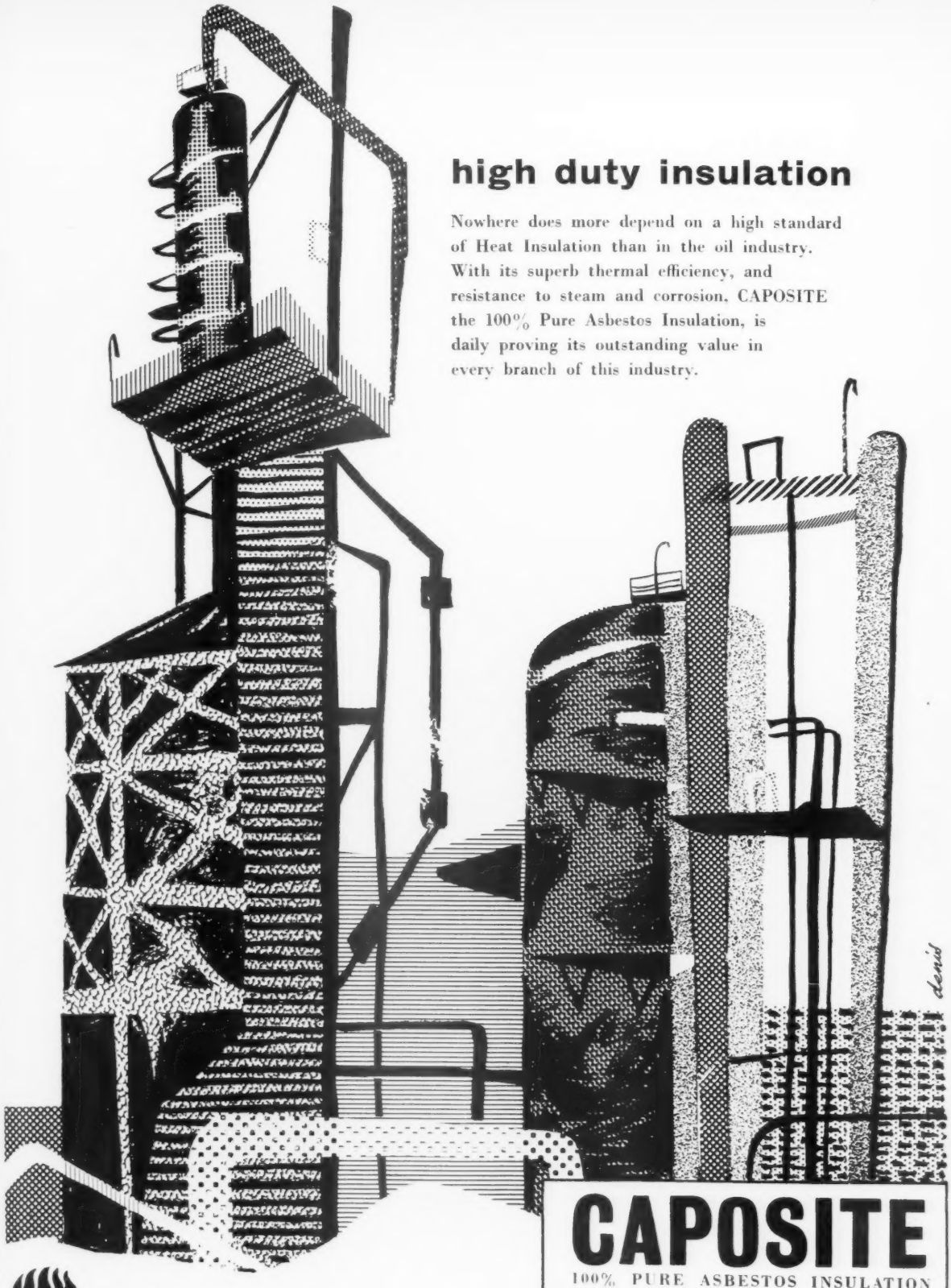

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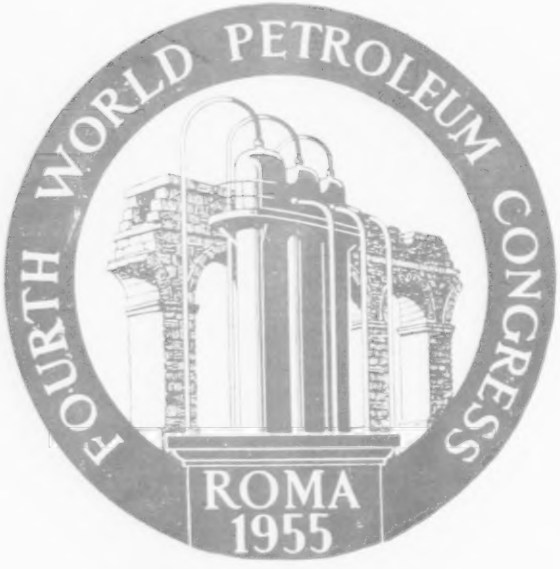

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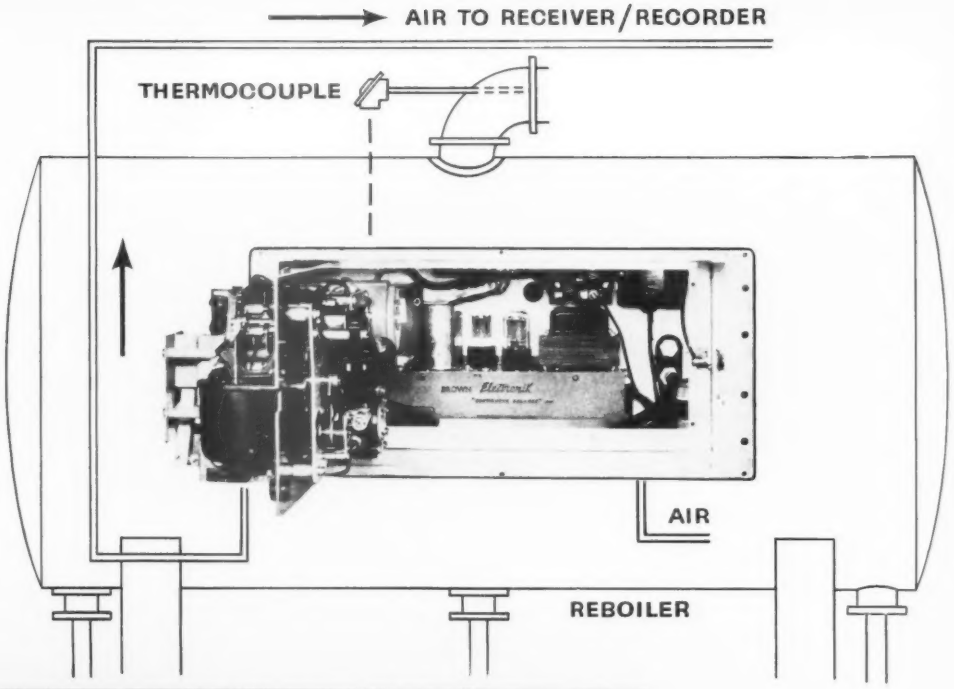

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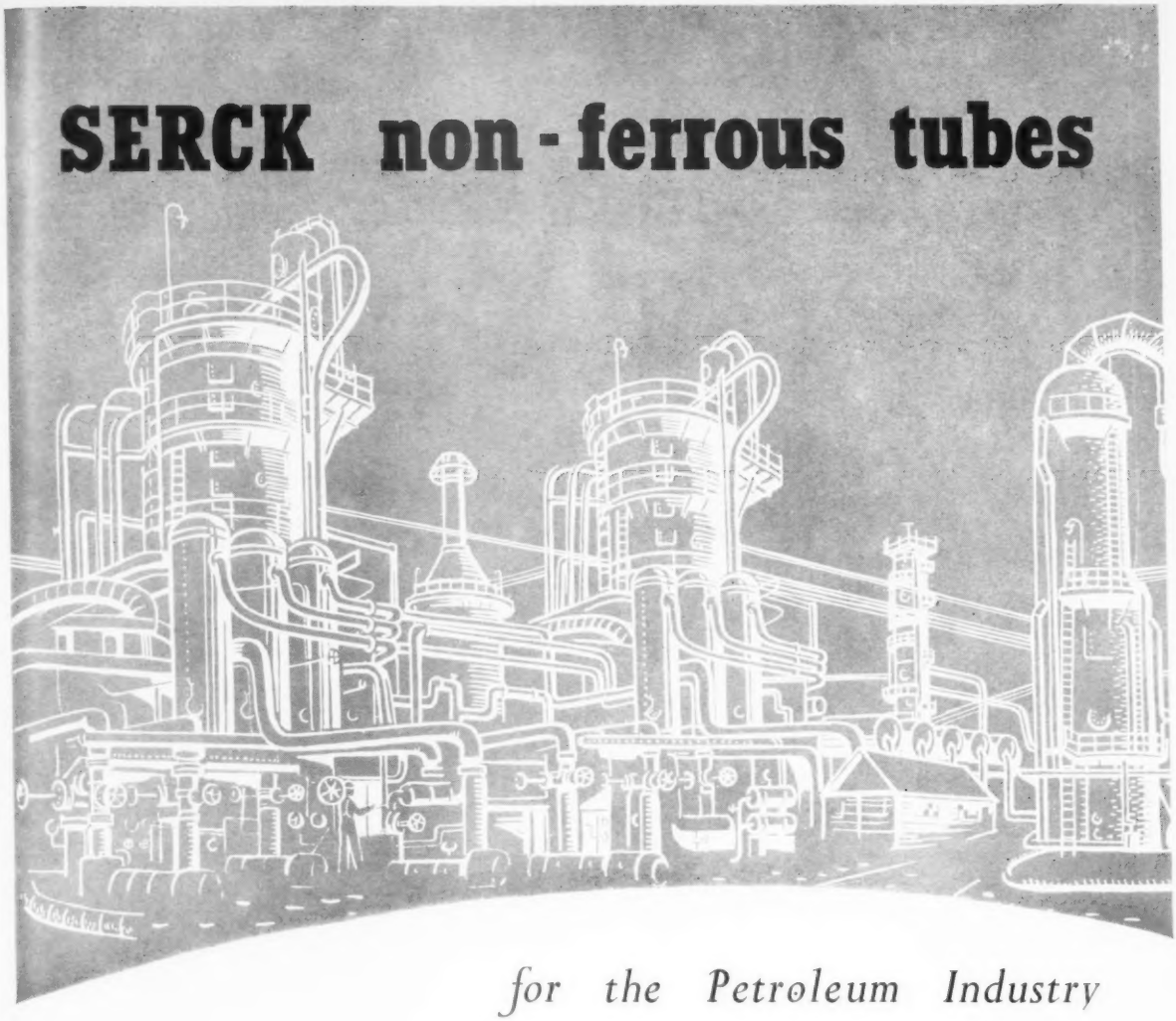

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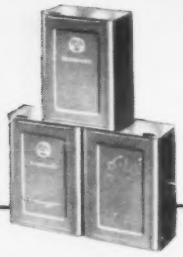

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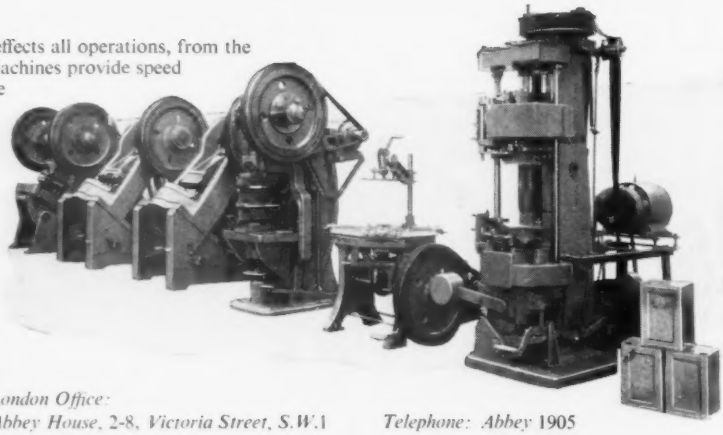

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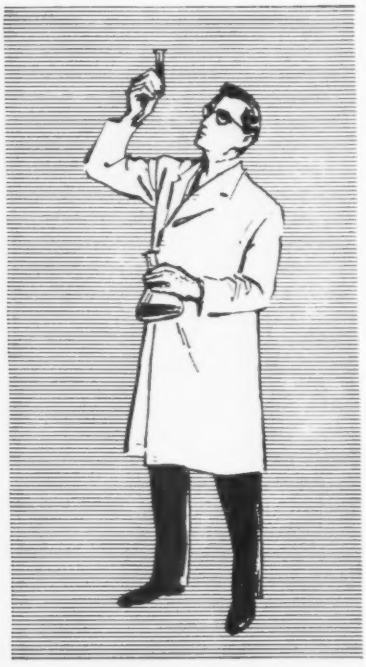

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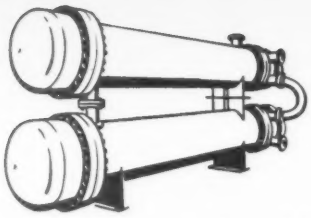

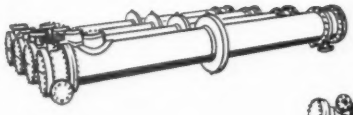

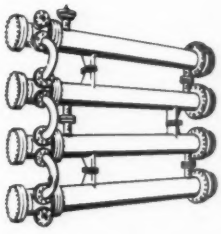

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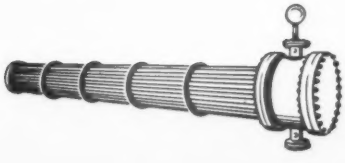

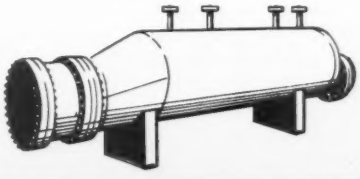

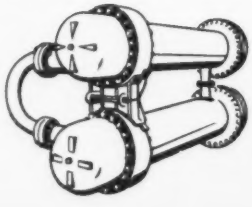

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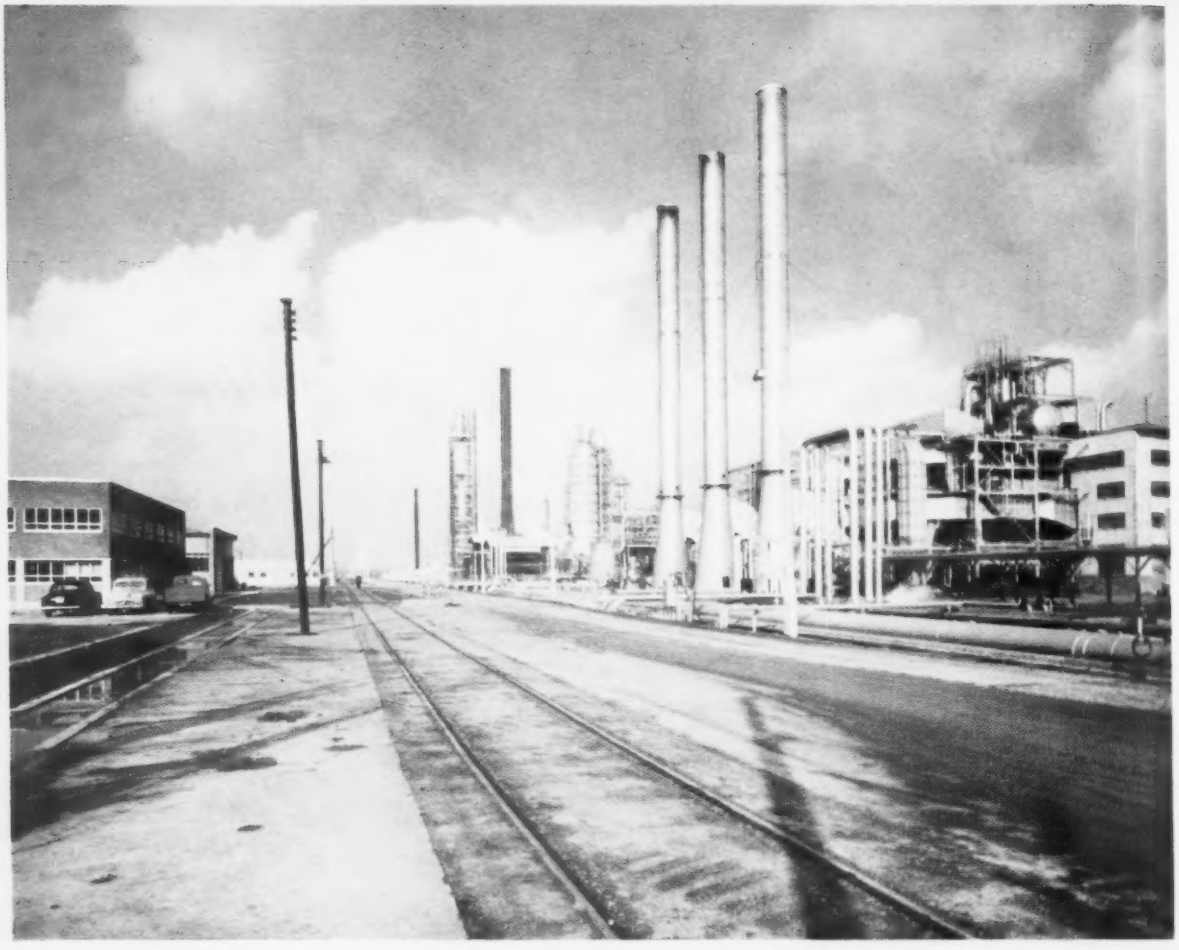

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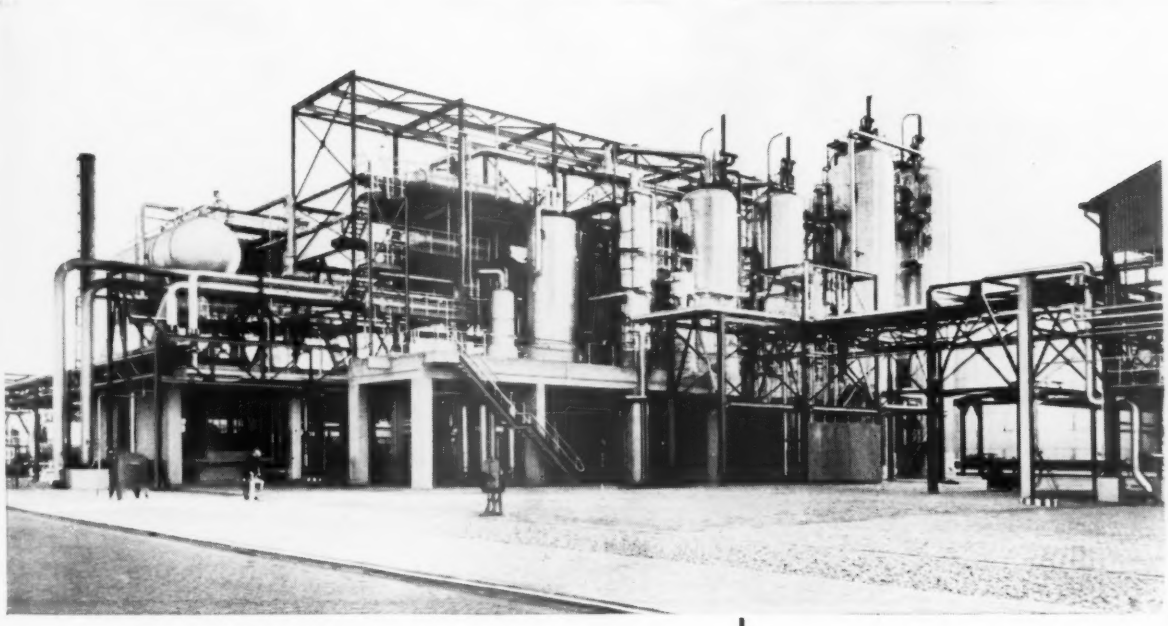

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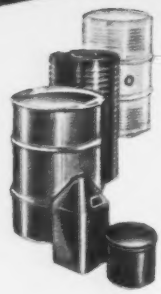

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